Including Ham Radio Fun!

73® Amateur Radio Today

DECEMBER 1996
ISSUE #435
USA $3.95
CANADA $4.95

International Edition

Be A Key Person
Internet Hamming

Packet Track - it
Stealth Attic Antenna
Shooting Straight Up
JBI Interface Kit

ANN ARBOR MI 48103-1553
300 N ZEEB RD
UNIV MICROFILMS IT
SERIALS PROCESSING DEPT
#00000191940#MR JUN76
**********5-DIGIT 48103
0 74851 08725 1

JRC

JST-245

160-10 Meters PLUS 6 Meter Transceiver

Fifteen reasons why your next HF transceiver should be a JST-245. . .

1 All-Mode Operation (SSB,CW,AM,AFSK,FM) on all HF amateur bands and 6 meters. JST-145, same as JST-245 but without 6 meters and built-in antenna tuner.

★ JST-145 COMING SOON ★

2 MOSFET POWER AMPLIFIER • Final PA utilizes RF MOSFETs to achieve low distortion and high durability. Rated output is 10 to 150 watts on all bands including 6 meters.

3 AUTOMATIC ANTENNA TUNER • Auto tuner included as standard equipment. Tuner settings are automatically stored in memory for fast QSY.

4 MULTIPLE ANTENNA SELECTION • Three antenna connections are user selectable from front panel. Antenna selection can be stored in memory.

5 GENERAL COVERAGE RECEIVER • 100 kHz-30 MHz, plus 48-54 MHz receiver. Electronically tuned front-end filtering, quad-FET mixer and quadruple conversion system (triple conversion for FM) results in excellent dynamic range (>100dB) and 3rd order ICP of +20dBm.

6 IF BANDWIDTH FLEXIBILITY • Standard 2.4 kHz filter can be narrowed continuously to 800 Hz with variable Bandwidth Control (BWC). Narrow SSB and CW filters for 2nd and 3rd IF optional.

7 QRM SUPPRESSION • Other interference rejection features include Passband Shift (PBS), dual noise blanker, 3-step RF attenuation, IF notch filter, selectable AGC and all-mode squelch.

8 NOTCH TRACKING • Once tuned, the IF notch filter will track the offending heterodyne (±10 Khz) if the VFO frequency is changed.

9 DDS PHASE LOCK LOOP SYSTEM • A single-crystal Direct Digital Synthesis system is utilized for very low phase noise.

10 CW FEATURES • Full break-in operation, variable CW pitch. built in electronic keyer up to 60 wpm.

11 DUAL VFOs • Two separate VFOs for split-frequency operation. Memory registers store most recent VFO frequency, mode, bandwidth and other important parameters for each band.

12 200 MEMORIES • Memory capacity of 200 channels, each of which store frequency, mode, AGC and bandwidth.

13 COMPUTER INTERFACE • Built-in RS-232C interface for advanced computer applications.

14 ERGONOMIC LAYOUT • Front panel features easy to read color LCD display and thoughtful placement of controls for ease of operation.

15 HEAVY-DUTY POWER SUPPLY • Built-in switching power supply with "silent" cooling system designed for continuous transmission at maximim output.

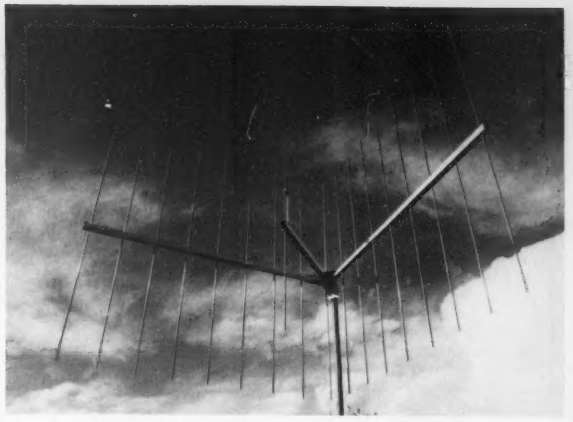
JRC *Japan Radio Co., Ltd.*

430 Park Ave., 2nd Floor New York, NY 10022 Phone: (212) 355-1180 Fax: (212) 319-5227

CIRCLE 159 ON READER SERVICE CARD

Corner Beam?

Big Forward Gain
Wide Backward Rejection
Exceptional Bandwidth
Distortion Free Pattern



Your antenna makes all the difference at VHF and UHF—It determines transmitting range. It sets the limit for weak signal reception. And it decides what interference you'll hear and create.

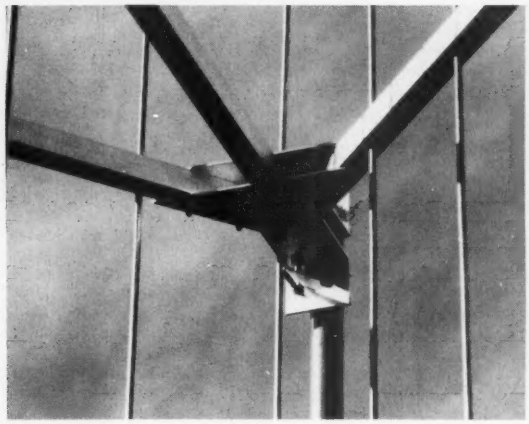
An omnidirectional antenna radiates uniformly in all direction, and it also hears noise and interference from every direction.

A directional antenna not only sends your signal where you want, it hears the signal it's pointed at, rejecting others. It also lets you operate with minimal power, cutting interference you inflict on other stations.

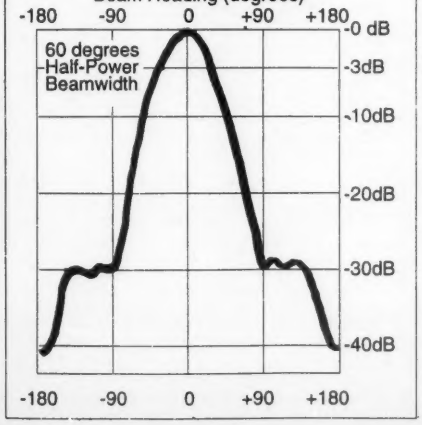
CornerBeam's clean sharp pattern without sidelobes or spikes reaches past the noise and interference to get the message through. Its wide rear rejection lets you null out strong nearby signals to reduce interference.

Look what CornerBeam does:

- •10 dB gain vs. dipole
- •40 dB Front-to-Back
- •60 degree Half-power Beamwidth
- •SWR <1.1:1 across the band
- •No dimension over 4 ft
- •Mounts directly to mast or tower
- •Vertical or horizontal polarization
- •No need for offset or side mount



Measured CornerBeam Pattern



Corner Beats Yagi

A yagi with the same gain would have a 10-ft boom. Yagi bandwidth would be less than half. More important, CornerBeam produces no side lobes, no back lobes.

Improved Data Communication

Because CornerBeam's pattern has no unwanted side spikes, phase noise is reduced to a minimum. The result is reduced data error rate, faster packet circuits. When you want a distortion free signal, think CornerBeam, not yagi.

CornerBeam for Repeaters

If your repeater shares a frequency with another, the deep wide null toward the rear could keep your signal out of the neighboring repeater's receiver and turn a deaf ear to its signal. A pair of CornerBeams can be combined to privide special radiation footprints. A CornerBeam aimed at an area your repeater hears poorly could improve service where incoming signals from HTs are presently too weak. CornerBeam makes it possible to increase repeater density while reducing interference.

Bandwidth Pays Off

With its exceptional bandwidth, your CornerBeam can be put to work right out of the box without special tweaking. It can serve you now when you're working repeaters with an FM handheld, and later when you set out to work satellites or go after small signal DX at 144.2 MHz.

CornerBeam can still be your beam when you join MARS at 143/148 MHz or team up with the sheriff's communications interface team at 158 MHz.

Scanning Too?

CornerBeam's gain & bandwidth extend monitoring range from aircraft to to marine & public service frequencies.■

On the Internet
www.itsnet.com/~radventr

Corner Beam Models

Band	Max Dim	WindLd	Price
2 meters	4 ft	<2 sqft	$145
220 MHz	4 ft	<1 sqft	$145
70 cm	3 ft	<1 sqft	$115
Dual 146/435	4 ft	<3 sqft	$165

Construction: Aircraft aluminum. Booms are square. Elements are solid rod. Stainless hardware included for tower and mast mounting accepts up to 1.5" dia. mast and may be rotated for vertical or horizontal polarization. Connector is SO-239 for VHF, N female for UHF. Dual-Band antenna has separate driven elements, weighs only 10 pounds.

Dimensions given in table are for reflector elements & booms.

Options: Commercial Frequency $45.

Duplexer: Add $80 for VHF/UHF Duplexer and cabling for single coax feed of Dualband 146/435 Corner.

Shipping: UPS ground to continental USA ($11 S&H). Air Parcel Post to HI, AK, & Posessions ($14 P&H). Canada ($16 P&H). Allow 2 weeks for delivery.

☐ Yes, I want Performance in My Corner!

___Send my CornerBeam: __2m, __220MHz, __70 cm, __Dual 146/435.

___Options: __DualBand Duplexer, __Commercial/Marine. Frequency:____

Name_____Amt. Enclosed_____

Call_____ Phone_____

Street_____Unit_____

City_____ State_____Zip_____

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CIRCLE 57 ON READER SERVICE CARD

Finally – A Professional-Quality Receiver to Monitor Weather Broadcasts!

NEW **Our new RWX is a very sensitive and selective Hamtronics® grade receiver to monitor critical NOAA weather broadcasts.**

Excellent 0.15µV sensitivity provides good reception even at distances of 70 miles or more with suitable antenna. No comparison with ordinary consumer radios!

Automatic mode provides storm watch, alerting you by unmuting receiver and providing an output to trip remote equipment when an alert tone is broadcast.

Essential for airports, police and fire departments, CAP, broadcast stations, state and local emergency managers, amateur repeaters – anyone needing a professional quality receiver. Because of its reasonable price, it is also handy for bikers, hikers, boaters, hunters, farmers – or anyone who needs up-to-date weather info and emergency warnings, even from distant stations.

Small enough for emergency or portable use, it can even be powered from a small 9-12V battery when needed. Crystal controlled for accuracy; **all 7 channels provided** (162.40 to 162.55).

You can buy just the receiver pcb module in kit form or buy the kit with an attractive metal cabinet, AC power adapter, and built-in speaker. It is also available factory wired and tested.

- RWX Rcvr kit, PCB only $79
- RWX Rcvr kit with cabinet, speaker, & AC adapter $99
- RWX Rcvr wired/tested in cabinet with speaker & adapter.....$139

WWV RECEIVER

NEW Get time and frequency checks without buying multiband hf rcvr. Hear solar activity reports affecting radio propagation. Very sensitive and selective crystal controlled superhet, dedicated to listening to WWV on 10.000 MHz. Performance rivals the most expensive receivers.

- **RWWV Rcvr** kit, PCB only $59
- **RWWV Rcvr** kit with cabt, spkr, & 12Vdc adapter $89
- **RWWV Rcvr** w/t in cabt with spkr & adapter $129

WEATHER FAX RECEIVER

Join the fun. Get striking images directly from the weather satellites! A very sensitive wideband fm receiver **optimized for reception of NOAA APT and Russian Meteor weather fax** images on the 137 MHz band.

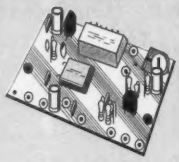
The R139 is lower cost and easier to maintain than synthesized units. And it is designed from the ground up for optimum satellite reception; not just an off-the-shelf scanner with a shorted-out IF filter!

Covers all five satellite channels. Scanner circuit and recorder control allow you to automatically search for and tape signals as satellites pass overhead, even while away from home.

- **R139 Receiver Kit** less case $159
- **R139 Receiver Kit** with case and AC power adapter.....$189
- **R139 Receiver w/t** in case with AC power adapter.....$239
- Internal PC Demodulator Board and Imaging Software $289
- Turnstile Antenna $119
- Weather Satellite Handbook $20

SUBAUDIBLE TONE ENCODER/DECODER

NEW **Access all your favorite closed repeaters with TD-5 CTCSS Encoder/Decoder**

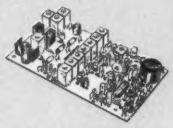


Encodes all standard subaudible tones with crystal accuracy and convenient DIP switch selection. Comprehensive manual also shows how you can set up a front panel switch to select between tones for several repeaters. Receiver **decoder** can be used to mute receive audio and is optimized for installation in repeaters to provide closed access. High pass filter gets rid of annoying buzz in receiver.

- **TD-5** CTCSS Encoder/Decoder Kit .....only **$39**
- **TD-5** CTCSS Encoder/Decoder Wired/tested **$59**

HIGH QUALITY VHF & UHF FM XMTR AND RCVR MODULES

FM EXCITERS: 2W output, continuous duty.



- **TA51:** for 6M, 2M, 220 MHz .. **kit $99, w/t $169.**
- **TA451:** for 420-475 MHz. ..... **kit $99, w/t $169.**
- **TA901:** for 902-928 MHz, (0.5W **out**).....**w/t $169.**

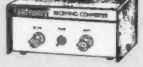
VHF & UHF POWER AMPLIFIERS.
Output levels from 10W to 100W **Starting at $99.**

FM RECEIVERS:

- **R100 VHF FM RECEIVERS** Very sensitive – 0.15µV. Superb selectivity – both crystal and ceramic IF filters, >100 dB down at ±12kHz, best available anywhere, flutter-proof squelch. For 46-54, 72-76, 140-175, or 216-225 MHz. .... **kit $129, w/t $189**
- **R144/R220 RCVRS.** Like R100, for 2M or 220 MHz, with helical resonator in front end.....**kit $159, w/t $219**
- **R451 FM RCVR,** for 420-475 MHz. Similar to R100 above. .....**kit $129, w/t $189**
- **R901 FM RCVR,** 902-928MHz .....**$159, w/t $219**

TRANSMITTING AND RECEIVING CONVERTERS

Go on a ham satellite adventure! Add another band for the next contest. Thrill in the excitement of building your own gear, and save a bundle.



No need to spend thousands on new transceivers for each band!

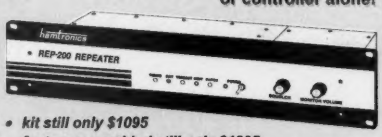
- Convert vhf and uhf signals to/from 10M.
- Even if you don't have a 10M rig, you can pick up very good used xmtrs & rcvrs for next to nothing.
- Receiving converters (shown above) available for various segments of 6M, 2M, 220, and 432 MHz.
- Kits from $49, wired/tested units only $99.

- Xmitting converters (at left) for 2M, 432 MHz.
- Kits only $89 vhf or $99 uhf.
- Power amplifiers up to 50W output.

Get more features for your dollar with our

REP-200 REPEATER

A microprocessor-controlled repeater with full autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!



- ***kit still only $1095***
- ***factory assembled still only $1295***

50-54, 143-174, 213-233, 420-475 MHz. (902-928 MHz slightly higher.) FCC type accepted for commercial service in 150 & 450 MHz bands.

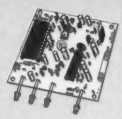
Digital Voice Recorder Option. Allows message up to 20 sec. to be remotely recorded off the air. Play back at user request by DTMF command, or as a periodical voice id, or both. **Great for making club announcements!** ..... only $100.

REP-200C Economy Repeater. **Real-voice ID,** no dtmf or autopatch. ..... Kit only $795, w&t $1195.

REP-200N Repeater. Without controller so you can use your own. ..... Kit only $695, w&t $995.

You'll KICK Yourself If You Build a Repeater

Without Checking Out Our Catalog First!



Hamtronics has the world's most complete line of modules for making repeaters. In addition to exciters, pa's, and receivers, we offer the following controllers.

COR-3. Inexpensive, flexible COR module with timers, courtesy beep, audio mixer. .....**only $49/kit, $79 w/t**

CWID. Traditional diode matrix ID'er. .....**kit only $59**

CWID-2. Eprom-controlled ID'er. ..**only $54/kit, $79 w/t**

DVR-1. Record your own voice up to 20 sec. For voice id or playing club announcements. .....**$59/kit, $99 w/t**

COR-4. Complete COR and CWID all on one board. ID in eprom. Low power CMOS. .....**only $99/kit, $149 w/t**

COR-8. COR with real-voice id. Low power CMOS, non-volatile memory. ..... **kit only $99, w/t only $149**

COR-5. µP controller with autopatch, reverse ap, phone remote control, lots of DTMF control functions, all on one board, as used in REP-200 Repeater. ..... **$379 w/t**

AP-3. Repeater autopatch, reverse autopatch, phone line remote control. Use with TD-2. ..... **kit $89**

TD-2. Four-digit DTMF decoder/controller. Five latching on-off functions, toll call restrictor. ..... **kit $79**

TD-4. DTMF controller as above except one on-off function and no toll call restrictor. Can also use for selective calling; mute speaker until someone pages you... **kit $49**

LOW NOISE RECEIVER PREAMPS

LNG-( ) G_AA_S FET PREAMPS
STILL ONLY $59!

- Make your friends sick with envy! Work stations they don't even know are there.
- Install one at the antenna and overcome coax losses.
- *Available for 28-30, 46-56, 137-152, 152-172, 210-230, 400-470, and 800-960 MHz bands.*

LNW-( ) ECONOMY PREAMPS
ONLY $29 kit, $44 wired/tested

- Miniature MOSFET Preamp
- Solder terminals allow easy connection inside radios.
- *Available for 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, and 400-500 MHz bands.*

- Buy at low, factory-direct net prices and save!
- For complete info, call or write for free catalog.
- Order by mail, fax, or phone (9-12 AM, 1-5 PM eastern time).
- Min. $5 S&H charge for first pound plus add'l weight & insurance.
- Use VISA, Mastercard, Discover, check, or UPS C.O.D.

See last month's ad for more products

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Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made upon publication. Please submit both a disk and a hard copy of your article (IBM (ok) or Mac (preferred) formats), carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens must include their Social Security number with submitted manuscripts so we can submit it to you know who.

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HAM RADIO FUN SECTION

K2OAW 64 **Communications Simplified, Part 12**

Thompson 77 **LED Checker Plus**
Make it even more useful.

On the cover: Santa stuffs stockings with goodies from Alinco. See "New Products." Photo by Jim Paliungas, Palimor Studios.

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

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Contract: By reading this fine print you have hereby legally bound yourself to try one new facet of amateur radio in the next 30 days. Are you on packet? If not, pick up a TNC and check it out. How about RTTY or AMTOR? You'll meet some pretty friendly hams on these modes. Even the DX will rag-chew.

NEVER SAY DIE

Wayne Green W2NSD/1

Bah, Humbug!

If you are the kind of person who tends to look on problems as challenges, our country and the world are sure full of challenges. We have some great challenges in Rwanda, Bosnia, Chechnya, Sri Lanka, India, Somalia, Haiti, Afghanistan, and so on. Here at home there's the challenge of straightening up the mess we've allowed our Congress to make of our school system, health care, drugs, poverty, and so on.

Outside of those global and national challenges, which call for you to cooperate with others interested in change in order to make a difference, which is probably asking too much, how about your personal challenges? How much thought have you given to making your own life happier and healthier? And that of your family?

How about a Christmas present of a few days in the Caribbean this winter? Or a ski vacation to Aspen? Or perhaps an extended weekend in Paris, London, Berlin, or Rome? Check out those travel agency specials. Hey, it beats the heck out of some pairs of socks. And with a little extra effort, you can get a temporary operating permit and bring along an HT so you can meet some local hams. We really *do* have a fraternity, you know.

I can guarantee that the hams on every Caribbean island will welcome you with a smile and want to show you around. Ditto the Hawaiian Islands, if they're closer.

None of this has to cost a bundle, once you know the ropes. Sherry and I are thrifty travelers (we're cheap). Hey, it's fun being thrifty, even when you don't have to. But the bottom line is that without spending a lot of money we've been to Europe, Asia, Africa, South America and the Pacific. Now what better Christmas present for your wife than a few days visiting, say, Guadeloupe? It's French, and the hams are beyond belief in friendliness.

Cost too much? Only if you believe that. Travel just doesn't have to cost a lot when you know the ropes. But my next suggestion is to give some books for Christmas. They can not only be fun to read, but help change lives. No, I'm not talking about the latest best-selling novels. Check back through my editorials for books I've reviewed or invest a big $5 in my 24-page list of recommended books (available from Radio Bookshop), and pick a few that are both fun and mind-expanding to give.

Or combine the two gifts so you and your wife will have some great books to take along to read on your next trip. I always bring at least a half dozen books on my trips. There is no better inexpensive gift than a well-chosen book.

Hey, if you run into any particularly good travel bargains, please drop me a note in case I might be able to get away for a few days too. There's still a bunch of great places my wife and I haven't visited yet.

The ARRL Election

Just as it has for the almost 60 years I've been a member, my ARRL biennial director election ballot arrived in the mail. I found myself with the choice of re-electing the current director, who I don't think I've ever met, or even worked on the air, but who looks like a nice enough old chap. Or the challenger, who was not wearing a jacket, his shirt collar was unbuttoned and tie pulled loose, which looked like good signs. But, sigh, it turned out he's been a member of the ARRL board for over 10 years. Sigh.

Hobson's choice, one insider or another. No fresh blood. No real choice.

And, oh yes, in their 300 allotted words they say they want to protect amateur radio's traditional values. I think that's the current shorthand for maintaining the code requirement so as to keep the hordes of no-coders ("they're not *really* hams") out of *our* already too crowded low bands.

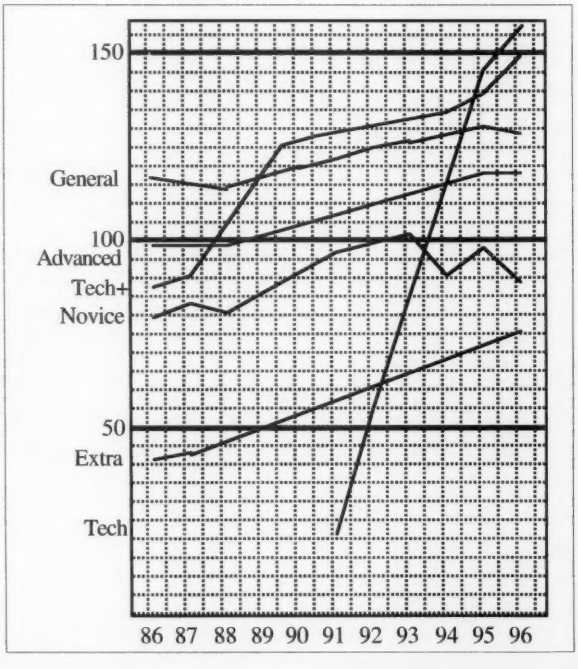
I haven't been keeping in close touch with the directors like I used to. Well, I used to provide a shoulder they could cry on about the stuff going on at HQ, and I was discreet about it. When Budlong was running the League with an iron hand he seldom had a problem with any directors getting elected that he couldn't control. He used to brag about how he could fix the elections. But I'm sure nothing like that is happening today.

My vote will go for the challenger. And two years from now, if I last that long, I'll vote for the new challenger. Never Re-elect Anyone. As a director, for Congress, or for President. Let's flush our political toilets as often as we can.

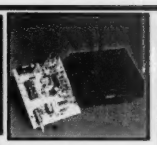
Ham Growth

The FCC figures for the last year are almost interesting. Growth? Well, we *did* gain 120 Advanced licensees during the last year. Of course that doesn't count the number of Advanced who got fed up with the hobby, got involved with other more important things (like golf), or dropped dead. Ooops, had their keys silenced. Well, gee, how about the General Class? With all those swarms of Techs coming in, our General Class must be bulging as they upgrade, right? Well, not quite. The number of Generals dropped by 1,841, not including those who, etc. Oh yes, the number of Novices dropped by 7,635. But then the number of Novices reached its peak in 1993. Yes, Techs and Tech+ are up, each by about 10,000 over last year. But Techs had been growing by about 30,000 a year for the four previous years, so this represents a surprising drop. About a 72% drop in one year! Yoiks. Is that a plummet?

Continued on page 13



Synthesized FM Stereo Transmitter



Microprocessor controlled for easy freq programming using DIP switches, no drift, your signal is rock solid all the time - just like the commercial stations. Audio quality is excellent, connect to the line output of any CD player, tape deck or mike mixer and you're on-the-air. Foreign buyers will appreciate the high power output capability of the FM-25; many Caribbean folks use a single FM-25 to cover the whole island! New, improved, clean and hum-free runs on either 12 VDC or 120 VAC. Kit comes complete with case set, whip antenna, 120 VAC power adapter - easy one evening assembly.

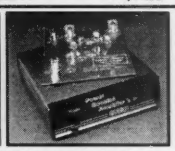
FM-25, Synthesized FM Stereo Transmitter Kit $129.95

Tunable FM Stereo Transmitter

A lower cost alternative to our high performance transmitters. Offers great value, tunable over the 88-108 MHz FM broadcast band, plenty of power and our manual goes into great detail outlining aspects of antennas, transmitting range and the FCC rules and regulations. Connects to any cassette deck, CD player or mixer and you're on-the-air, you'll be amazed at the exceptional audio quality! Runs on internal 9V battery or external power from 5 to 15 VDC, or optional 120 VAC adapter. Add our matching case and whip antenna set for a nice finished look.

FM-10A, Tunable FM Stereo Transmitter Kit..... $34.95
CFM, Matching Case and Antenna Set..... $14.95

RF Power Booster Amplifier



Add some serious muscle to your signal, boost power up to 1 watt over a frequency range of 100 KHz to over 1000 MHz! Use as a lab amp for signal generators, plus many foreign users employ the LPA-1 to boost the power of their FM Stereo transmitters, providing radio service through an entire town. Power required: 12 to 15 volts DC at 250mA, gain of 38dB at 10 MHz, 10 dB at 1000 MHz. For a neat, professionally finished look, add the optional matching case set.

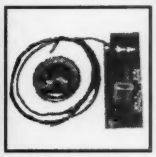
LPA-1, Power Booster Amplifier Kit..... $39.95
CLPA, Matching Case Set for LPA-1 Kit..... $14.95
LPA-1WT, Fully Wired LPA-1 with Case..... $99.95

Micro FM Wireless Mike

World's smallest FM transmitter. Size of a sugar cube! Uses SMT (Surface Mount Technology) devices and mini electret condenser microphone, even the battery is included. We give you two complete sets of SMT parts to allow for any errors or mishaps-build it carefully and you've got extra SMT parts to build another! Audio quality and pick-up is unbelievable, transmission range up to 300 feet, tunable to anywhere in standard FM band 88 to108 MHz. 7/8"w x 3/8"h x 3/4"h.

FM-5 Micro FM Wireless Mike Kit..... $19.95

Crystal Controlled Wireless Mike



Super stable, drift free, not affected by temperature, metal or your body! Frequency is set by a crystal in the 2 meter Ham band of 146.535 MHz, easily picked up on any scanner radio or 2 meter rig. Changing the crystal to put frequency anywhere in the 140 to 160 MHz range-crystals cost only five or six dollars. Sensitive electret condensor mike picks up whispers anywhere in a room and transmit up to 1/4 mile. Powered by 3 volt Lithium or pair of watch batteries which are included. Uses the latest in SMT surface mount parts and we even include a few extras in case you sneeze and loose a part!

FM-6, Crystal Controlled FM Wireless Mike Kit..... $39.95
FM-6WT Fully Wired FM-6..... $69.95

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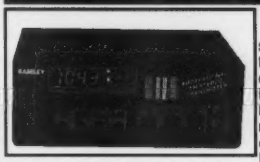


A truly professional frequency synthesized FM Stereo transmitter station in one easy to use, handsome cabinet. Most radio stations require a whole equipment rack to hold all the features we've packed into the FM-100. Set frequency easily with the Up/Down freq buttons and the big LED digital display. Plus there's input low pass filtering that gives great sound no matter what the source (no more squeals or swishing sounds from cheap CD player inputs!) Peak limiters for maximum 'punch' in your audio - without over modulation, LED bargraph meters for easy setting of audio levels and a built-in mixer with mike and line level inputs. Churches, drive-ins, schools and colleges find the FM-100 to be the answer to their transmitting needs, you will too. No one offers all these features at this price! Kit includes sharp looking metal cabinet, whip antenna and 120 volt AC adapter. Also runs on 12 volts DC.

We also offer a high power export version of the FM-100 that's fully assembled with one watt of RF power, for miles of program coverage. The export version can only be shipped outside the USA, or within the US if accompanied by a signed statement that the unit will be exported.

FM-100, Professional FM Stereo Transmitter Kit..... $299.95
FM-100WT, Fully Wired High Power FM-100..... $429.95

Speech Descrambler Scrambler

Decode all that gibberish! This is the popular descrambler / scrambler that you've read about in all the Scanner and Electronic magazines. The technology used is known as speech inversion which is compatible with most cordless phones and many police department systems, hook it up to scanner speaker terminals and you're in business. Easily configured for any use: mike, line level and speaker output/inputs are provided. Also communicate in total privacy over telephone or radio, full duplex operation - scramble and unscramble at the same time. Easy to build, all complex circuitry contained in new custom ASIC chip for clear, clean audio. Runs on 9 to 15VDC, RCA phono type jacks. Our matching case set adds a super nice professional look to your kit.

SS-70A, Speech Descrambler/Scrambler Kit..... $39.95
CSS, Custom Matching Case and Knob Set..... $14.95
SS-70AWT, Fully Wired SS-70A with Case..... $79.95
AC12-5, 12 Volt DC Wall Plug Adapter..... $9.95

Tone-Grabber Touch Tone Decoder / Reader

Dialed phone numbers, repeater codes, control codes, anywhere touch-tones are used, your TG-1 will decode and store any number it hears. A simple hook-up to any radio speaker or phone line is all that is required, and since the TG-1 uses a central office quality decoder and microprocessor, it will decode digits at virtually any speed! A 256 digit non-volatile memory stores numbers for 100 years - even with the power turned off, and an 8 digit LED display allows you to scroll through anywhere in memory. To make it easy to pick out numbers and codes, a dash is inserted between any group or set of numbers that were decoded more than 2 seconds apart. The TG-1 runs from any 7 to 15 volt DC power source and is both voltage regulated and crystal controlled for the ultimate in stability. For stand-alone use add our matching case set for a clean, professionally finished project. We have a TG-1 connected up here at the Ramsey factory on the FM radio. It's fun to see the phone numbers that are dialed on the morning radio show! Although the TG-1 requires less than an evening to assemble (and is fun to build, too!), we offer the TG-1 fully wired and tested in matching case for a special price.

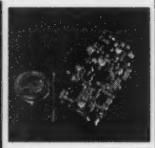
TG-1, Tone Grabber Kit..... $99.95
CTG, Matching Case Set for TG-1 Kit..... $14.95
TG-1WT, Fully Wired Tone Grabber with Case..... $149.95
AC12-5, 12 Volt DC Wall Plug Adapter..... $9.95

Mini-Peeper Micro Video Camera

Super small, high quality fully assembled B & W CCD TV camera the size of an ice cube! Provides excellent pictures in low light (2 lux), or use our IR-1 Infra-Red light source to invisibly illuminate an entire room on a pitch black night! Imagine the possibilities... build it into a smoke detector, wall clock, lamp, book, radio. Exact same camera that's in big buck detective catalogues and stores. Kit includes: fully assembled CCD camera module, connectors, interface PC board kit with proper voltage regulation and filtering, hook-up details, even a mini microphone for sensitive sound! Two models available: Wide Angle Lens 3.6mm/f2, adjustable focus lens, 92 degree view; Pinhole Lens 5.5mm/f4.5, 60 degree view. The Pinhole Lens is physically much flatter and provides even greater depth of focus. The camera itself is 1.2" square. The Wide Angle Lens is about 1" long, Pinhole Lens about 1/2", interface PC board is 1" x 2" and uses RCA jacks for easy hook-up to VCRs, TVs or cable runs. Power required is 9 to 14 VDC @ 150 mA. Resolution: 380 x 350 lines. Instruction manual contains ideas on mounting and disguising the Mini-Peeper along with info on adding one of our TV Transmitter kits (such as the MTV-7 unit below) for wireless transmission!

MP-1, Wide Angle Lens CCD TV Camera Outfit..... $169.95
MP-1PH, Pin-Hole Lens CCD TV Camera Outfit..... $189.95

MicroStation Synthesized UHF TV Transmitter



Now you can be in the same league as James Bond. This transmitter is so small that it can fit into a pack of cigarettes - even including a CCD TV camera and battery! Model airplane enthusiasts put the MTV-7A into airplanes for a dynamite view from the cockpit, and the MTV-7A is the transmitter of choice for balloon launches. Transmitter features synthesized, crystal controlled operation for drift-free transmission of both audio and video on your choice of frequencies: Standard UHF TV Channel 52 (which should only be used outside of the USA to avoid violating FCC rules), and 439.25 MHz or 911.25 MHz which are in the amateur ham bands. The 439.25 MHz unit has the nifty advantage of being able to be received on a regular 'cable-ready' TV set tuned to Cable channel 68, or use our ATV-74 converter and receive it on regular TV channel 3. The 911.25 MHz unit is suited for applications where reception on a regular TV is not desired, an ATV-79 must be used for operation. The MTV-7A's output power is almost 100 mW, so transmitting range is pretty much 'line-of-sight' which can mean many miles! The MTV-7A accepts standard black and white or color video and has its own, on-board, sensitive electret micorphone. The MTV-7A is available in kit form or fully wired and tested. Since the latest in SMT (Surface Mount Technology) is used to provide for the smallest possible size, the kit version is recommended for experienced builders only. Runs on 12 VDC @ 150 mA and includes a regulated power source for a CCD camera.

MTV-7A, UHF TV Channel 52 Transmitter Kit..... $159.95
MTV-7AWT, Fully Wired Channel 52 Transmitter..... $249.95
MTV-7A4, 439.25 MHz TV Transmitter Kit..... $159.95
MTV-7A4WT, Fully Wired 439.25 MHz Transmitter..... $249.95
MTV-7A9, 911.25 MHz TV Transmitter Kit..... $179.95
MTV-7A9WT, Fully Wired 911.25 MHz Transmitter..... $269.95
ATV-74, 439.25 MHz Converter Kit..... $159.95
ATV-74WT, Fully Wired 439.25 MHz Converter..... $249.95
ATV-79, 911.25 MHz Converter Kit..... $179.95
ATV-79WT, Fully Wired 911.25 MHz Converter..... $269.95

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LETTERS

From the Ham Shack

Tony Mortimer KA8ICF. So the powerful ARRL has thrown a monkey wrench into Wayne Green's speaking at the Dayton HamVention. Gosh, such power the League has over the HamVention folks. Hmmm, I spoke to Dave Forbes KD8FO at the HamVention. He is the chairman of the Forums and Speakers committee. I told him I was disappointed and somewhat ticked off that the HamVention refused to include Wayne Green among their speakers. Dave told me that this was *your* choice and not theirs. He also said that you demanded a $1,000 speaking fee, plus all of your expenses (first class air travel, hotel, food) to be paid. Since the HamVention doesn't pay speakers, they declined. I think it is high time you level with your readers. You didn't exactly lie, you just didn't tell the whole truth and nothin' but the truth. And big bucks Wayne—"easy money"—whining that he can't make any money being an exhibitor at Dayton, so he pulls out. What about the 300 plus other exhibitors Wayne? They smarter and better business people than you. Well Wayne?

Fascinating! Never, since I gave my first talk in 1955 at Dayton, have I ever demanded a speaking fee or travel expenses. Most conferences, such as the Tesla Society and Global Sciences Congress, recognizing that well-known speakers tend to attract more attendees, do pay the travel and hotel costs for speakers. And since the HamVention forum chairmen in the past have told me that I pulled the biggest crowd of any speaker, I was surprised in 1995 when I was not asked to speak. I was less surprised when the rumor mill claimed that there was some bragging about a League official having a hand in this. So, back in February, having again not been asked to speak, I sent a letter explaining that I had a particularly important message this year. No answer. Below is a copy of my February letter to Ken Allen KB8KE, who was the listed forum chairman. By the way, "Big Bucks Wayne" is well known as "Never Spend a Dollar." I'm not cheap, I'm just thrifty, as anyone who's read my travel books will attest. So when I find that I'm losing money exhibiting at Dayton and can use the same money to send out a mailing and pull in two to three times as many subscriptions, guess where my money goes? I've found that Dayton is not a cost-effective way to sell magazines. Maybe you remember the big booth Ham Radio used to have? Look where it got them. Pffft ... Wayne

"From W2NSD/1 to: Ken Allen KB8KE, Forum Chairman. While I was disappointed to again not be invited to be on the program, I can understand the pressures you must be under from the League ... I'm their worst nightmare and you certainly can't afford to offend them. I've heard from several sources how they're gloating over being able to keep me off the program. My message this year is the most important I've had since I first spoke at Dayton in 1955. I'm calling for every ham club in the country to do their utmost to get at least one local ham elected to their state legislature. The next step is for this person to get on the educational committee and introduce a bill getting the state's schools to initiate an eight-year course in the fundamentals of electronics, communications, and computers for grades 5-12. Our country desperately needs high-tech career citizens to design, manufacture, sell, operate, and service the high-tech products which will dominate both business and home in the 21st century. This can help us get radio clubs started in every school in the country and revive the high growth we had from 1946 to 1964 (11% per year, steadily for 18 years!). Without something dramatic like this, how many years can we really hope to keep our hobby going, considering the mounting commercial pressures for spectrum and the billions they are willing to pay for it? Ham legislators have an added benefit to us of being able to provide some clout when matters of interference and antenna restrictions come up. We need to infiltrate the state legislatures, so I'm really disappointed that I won't be able to get this message across at the HamVention this year ... Wayne."

Jason Spitzer KD6HYB. There are a few (three or four, I suppose) of us out here who would like to use our Macs for ham radio related things. For example, I'm really interested in getting into the digital modes like packet, but it seems the entire hobby—more so than the computer field as a whole—is dominated by DOS/Windoze software and equipment. I really don't want to have to buy another computer (even a used junker) just to get into this area. I've used both platforms extensively, and, frankly, I like my Macintosh. Anyway, can you at some point run an article catering to the Mac ham minority out here? Possibly cover sources of hardware/software, etc.? I might also add that, due to their ease of use, the Mac is really an ideal computer for newcomers to the ham radio/computer topic. It really seems like there should be more demand.

Finally, in case you haven't noticed, the world below 30 MHz has become pretty much unusable for most of us city dwellers without the $$ to go out and buy a lot of expensive DSP equipment. The static caused by cheap lamps, dimmer switches, computer hash, and the like have made an incredible spectral mess. Heck, I can't even tolerate listening to the local WJJD 1160 AM 50 kW blowtorch at night, due to the anthropogenic noise! And shortwave broadcast listening is out of the question. It's really out of hand, Wayne; I've had a Tech-plus license for over three years now, and I've studied all the way through to advanced. But why should I bother to upgrade when I can't copy anything through the noise? Even when I eliminate all RF noise sources from my house, the neighbors are still using their

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junk. I don't know what to do about the problem. Certainly, manufacturers could spend a few extra cents and design some noise limiting features into their electronic products. But, no doubt, these folks had their lobbyists in Washington when the FCC and legislators were establishing standards.

Your best bet is to live on a farm in New Hampshire where there are no neighbors and then throw out all your touch-lamps. That's what I've done ... Wayne.

Kent Hufford KQ4KK. In your August editorial in the section "Is CW Dead?" you state that knowing the code helped Scott O'Grady get out of Serb-held Bosnia. That's incorrect. Scott O'Grady did not send any Morse code (CW) any time during his ordeal in Bosnia. Scott never memorized the Morse alphabet. He did send a beacon and voice mode while there.

How do I know? In June 1995 I was assigned as the Chief of Staff Army's representative to the Chairman of the Joint Staff investigations of the shootdown and the successful recovery of Basher 52 (Capt. O'Grady). I spent a week in the AOR, was on the Teddy Roosevelt, the USS Kearsarge, in Naples, Stuttgart, etc., on the investigation team. We studied the intelligence data and interviews with four-star rank on down. On our return to the US we interviewed Scott at Andrews Air Force Base. I had heard the story of his sending CW, but when I asked him about it, he replied, "What's CW?" I explained it was Morse code. He said he had not sent any Morse code and that while the older survival radios had a code sheet, the new ones did not. Scott was a very lucky guy, but the code did not help him. CW is OK, it just shouldn't be mandatory. Nor supported by a myth.

Thanks, Kent, for putting our CW-mongers straight on this. Though my ability to copy code saved my life and my submarine during WWII, I agree with you that the code should be learned and used for fun and no longer be mandatory ... Wayne.

George Lydecker KD6NEW. At last, an intelligent article about repeater coordination. Glen Zook's article expressed the frustration that many of us feel with repeater coordination as it now exists.

I'm one of those hams who live in Los Angeles under the disparity between open and closed repeaters on the 70 cm band. A quick check of any repeater guide for the 440 band shows that well over 90% of the repeaters listed are private or closed. SCRRBA, the Southern California Repeater and Remote Base Association, felt the need to coordinate yet one more private "members only" repeater to a store owner using it to help sell ham gear. This guy is also a member of the SCRRBA Coordinating Committee. SCRRBA allocated the same frequency pair to this store owner as was being used by one of the last open 70 cm community repeaters. This repeater has been coordinated and in use for all since 1993, and has provided public service for both the ham community and the public. Listen to the Metropolitan Amateur Repeater System Monday night net and you will hear friends and families using ham radio in the way it was intended. Each net begins with an open invitation to all licensed hams. This net gave me my first exposure to talking to other hams. I was made to feel welcome and I was treated as a peer. The new repeater owner, claiming eminent domain granted by SCRRBA, began a campaign to chase the open repeater users off. The situation got so bad that this guy was jamming the channel during nets.

We have hams who are as young as eight years old who would be virtually excluded from the use of 440 by the fees charged by these "business" repeaters. I listened as one young eight-year-old made her first check-in to a net, only to be jammed. And all this is under the endorsement of the SCRRBA.

Surely you exaggerate! Not even money and politics could make such a terrible situation here in America ... Wayne.

Hoka Code 3 Gold

"The most advanced Digital Signal Processing PC program for the analysis and decoding of HF data communications!"

Code 3 Gold makes decoding easy for the novice and expert. Unlike the CW/RTTY decoders, Code 3 is an exclusive auto classification that tells you what you are listening to (30 + modes) and automatically sets you up to start decoding. Automatic analysis and oscilloscope functions are both selectable from almost anywhere in the program. The six Main Menu screens make moving around the Code 3 Gold program a snap. Code 3 is the most sophisticated and emcompassing decoder available. The 26 standard modes include:Package includes: Code 3 Gold software, audio-digital converter and RS232 cable, all ready to go! **Requirements:** IBM compatible, MSDOS with 640kB of Ram, CGA or better monitor.

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- SWED-ARQ-ARQ-SWE
- ARQ-E/ARQ1000 Duplex
- ARQ-N-ARQ-1000 Duplex Varient
- ARQ-E3-CCIR519 Variant
- POL-ARQ 100 Baud Duplex ARQ
- TDM242/ARQ-M2/4-242
- TDM342/ARQ-M2/4
- FEC-A FEC100A/FEC101
- FEC-S
- FEC1000 Simplex
- Sports info 300 baud ASCII
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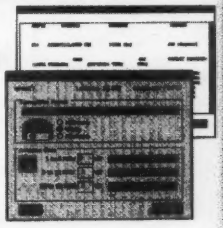

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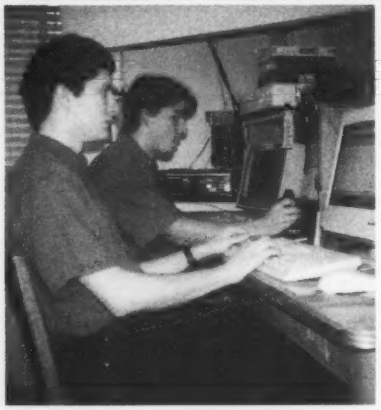


Today's Young Hams Are Our Future

On the left is Alex Zagajewski N2UAO. Alex is a charter member of the Taconic Hills High School Amateur Radio Club (THHSARC) KB2YLU, and graduated fourth in his class. He was an honors student throughout high school, played varsity soccer and was the first student to successfully complete the Foundations of Research Class at THHS. Alex's project was a study of the effects of RF radiation at 146 MHz on cultured nerve cells. Alex is a member of the Rip Van Winkle Amateur Radio Society (RVWARS), has served as Field Day chairman for two years, often served as net control for the weekly ARES Net and has participated in many public service events. Alex is currently a freshman at PACE University in New York majoring in Computer Science and Mathematics.

On the right is Kyrilian Dyer N2TZT. Kyrilian is also a charter member of the THHSARC and was the Valedictorian of the THHS class of 1996. He also played varsity soccer. He is a member of RVWARS and has participated in Field Day and other public service events. Kyrilian holds a private pilot's license and can be heard aeronautical mobile over Columbia County and surrounding areas. Kyrilian is currently a freshman at MIT in Massachusetts, majoring in Aeronautical Engineering. Both Alex and Kyrilian have been Elmering other students at THHS and at a private school near THHS.

Thanks, Wayne Gearing N2ROR, for the above.

Phase 3-D Slated for Launch in April 1997 on Ariane 502

Paris, France (AMSAT News Service) — In a published report released Thursday, September 26, by the European Space Agency (ESA), Mr. Jean-Marie Luton, Director General of ESA, and Mr. Alain Bensoussan, Chairman of CNES (the French Space Agency) announced that the launch of Ariane 502 has now been tentatively set for mid-April 1997. It was also confirmed that the Phase 3-D International Amateur Radio Satellite will be on this flight. The other payloads are to be a pair of technological measurement packages for validation of the launch vehicle's ability to place two satellites into a geostationary transfer orbit (GTO).

These announcements came during a joint ESA-CNES press conference at ESA Headquarters in Paris called to outline the respective plans of the two agencies to correct identified deficiencies in the Ariane 5 launch vehicle. The actions are in direct response to a comprehensive report submitted in July by the Ariane 501 Inquiry Board that was chartered to investigate the loss on launch of the first Ariane 5 booster in early June.

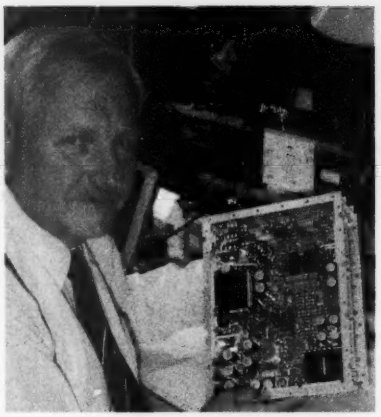
During the press conference, it was also reported that ESA's Atmospheric Reentry Demonstrator (ARD), a technology demonstration capsule for a future European manned space transport vehicle, along with an as yet unspecified commercial payload, is to be flown on a subsequent Ariane 5 vehicle, Ariane 503, which has been made a part of the Ariane-5 qualification process. This flight could take place in September 1997. The ARD had earlier been slated to fly on Ariane 502 along with the AMSAT Phase 3-D satellite.

In their announcement, Mr. Luton and Mr. Bensoussan outlined several specific actions that are now being taken by ESA and CNES to assure the correction of software contained in the Ariane 5 inertial reference system. Errors in this software were previously reported by ESA as being one of the primary causes of the Ariane 501 failure. Corrective actions include making changes to the Ariane 5 Functional Simulation Facility to make the qualification tests more representative of the flight environment as well as performing a comprehensive review of all the embedded software contained in the launch vehicle.

ESA and CNES also announced that the industrial architect on the Ariane project will henceforth assume the role of "software architect." This change will allow not only for verification of all software incorporated in equipment but also will help ensure the overall functional integrity of the launcher. Mr. Luton and Mr. Bensoussan went on to note that this means that all of the launch vehicle's software will now become subject to qualification reviews in which outside experts will take part.

In addition, the joint ESA and CNES announcement reported that working methods used in the Launcher Qualification Review have now been modified to introduce specialized audits on the most complex launcher systems in order to provide closer analysis wherever this is deemed necessary. A comprehensive review of the launcher's qualification is now also reported to be underway, along with systematic efforts to identify "degraded" modes of operation that could affect launcher elements.

AMSAT is a not-for-profit, 501(c)(3) educational and scientific organization that was first chartered in Washington, D.C., USA. Its objectives include promoting space research and communication by building, launching and controlling Amateur Radio spacecraft. Since its founding, over 25 years ago, many other like-minded organizations have been formed around the world to pursue the same goals and who now also share the AMSAT name. Often acting together, these groups have used predominantly volunteer labor and donated resources to design, construct, and, with the added assistance of government and commercial space agencies, successfully launch, over two dozen Amateur Radio communications satellites into Earth orbit.



Dr. Andras (Bandi) Gschwindt HA5WH proudly displays Phase 3-D's Battery Charge Regulator (BCR) at the Marburg P3-D Lab. The BCR is a critical piece of Phase-3-D flight hardware that will control all the spacecraft's onboard power activity such as regulating battery charging from the solar panels. The BCR was built by Bandi and his team at the Technical University of Budapest, Hungary.

The Phase 3-D satellite, now under construction with the help of over a dozen AMSAT groups on five continents, will be the largest, most complex, and most expensive Amateur Radio satellite ever built.

For more information, contact:

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D-35041 Marburg, Germany
Phone: (06421) 684121
FAX: (06421) 285665
Internet: "dj5kq@amsat.org"

You Know It's Time to Get a New Hobby When...

You're saying grace over a meal with your family, and you finish, "N4TMI clear, er, Amen."

TNX Michael Covington N4TMI (from *ARNS*, March 1995). 73

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- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

• LOW PROFILE POWER SUPPLY

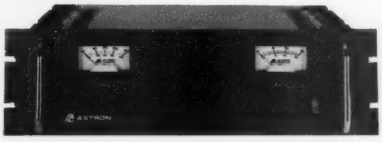
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅞ × 9¼	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅞ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



MODEL RM-35M

• 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

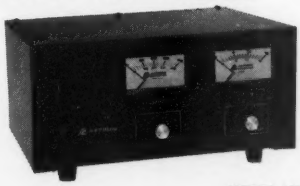
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES



MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
VS-70M	67	34	16	70	6 x 13¾ x 12⅛	48
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

Number 10 on your Feedback card

Automatic Packet Reporting System (APRS)

Holy packet, Batman! We can track anything with this!

Bob Bruninga WB4APR
115 Old Farm Ct.
Glen Burnie MD 21060

APRS is a radical change to packet radio, adding a map display, a new protocol, and a simple routing scheme to communicate the positions of stations, objects, vehicles, and other graphical information in real time over standard AX.25 packet. It was designed to improve the value of ham radio in emergency situations or public service events by taking advantage of this visual tactical display. In the past, packet radio has mostly been used for passing volumes of message traffic from point to point, but has seen little use for real-time events where information has a very short lifetime. APRS reverses this trend by rapidly communicating small packets of information to all stations simultaneously. The keys to the success of APRS are: map displays to see the locations of stations and objects; unconnected/broadcast packets to all stations at once; generic digipeater routing independent of callsigns; APRS versions for the Mac, Windows, and DOS.

Map displays

Maps at any scale, from the whole world for HF and satellite communications down to the inside of the Dayton HamVention Arena, are possible! In addition to geographical displays, APRS

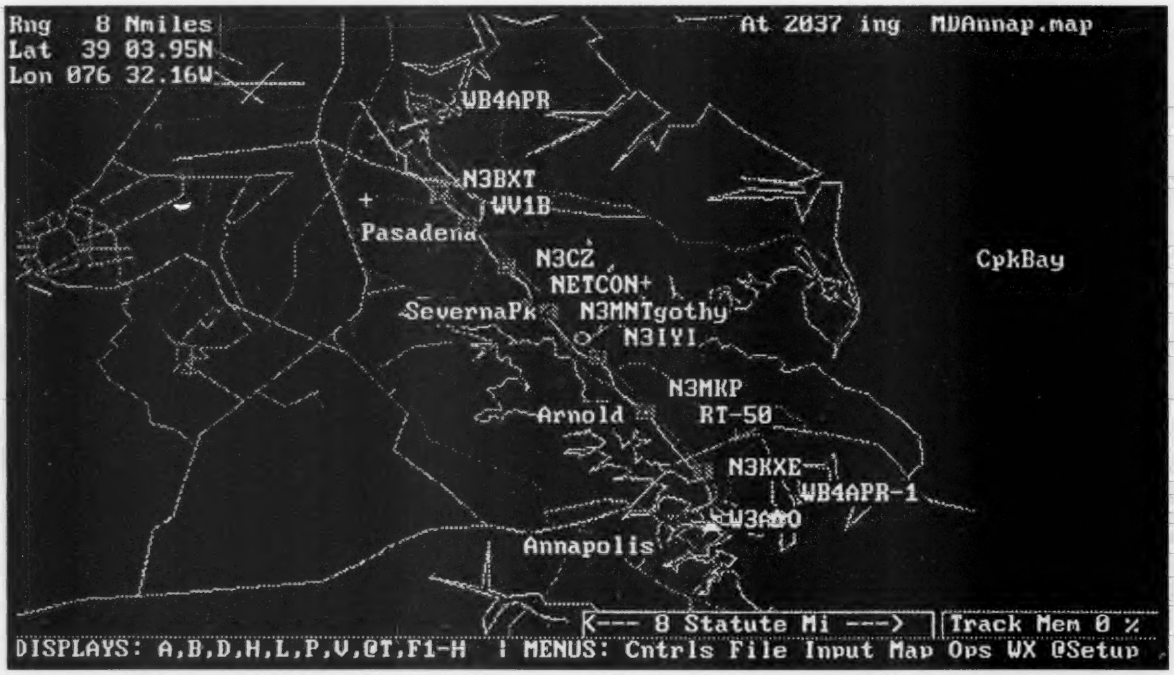


Photo A. *At this marathon in Annapolis, MD, the police officer at each checkpoint found the map display to be very valuable in predicting the arrival of the runners so that traffic could be stopped for street crossings.*

MFJ *HF/VHF* SWR Analyzer™

. . . Read your antenna SWR from 1.8 to 170 MHz . . . built-in 10 digit LCD frequency counter. . . RF Resistance Meter™. . . smooth vernier tuning . . .

MFJ-259 **$239.95**

MFJ-259 handheld *Univeral SWR Analyzer™* lets you read your antenna SWR from 1.8 to 170 MHz quickly and easily without any other equipment!

MFJ's exclusive *RF Resistance Meter™* lets you measure RF resistance up to 500 ohms at minimum SWR.

Has built-in 10 digit LCD frequency counter and smooth vernier tuning.

You get *four* instruments in one . . . 10-digit frequency counter . . . RF signal generator. . . SWR Analyzer™. . . *RF Resistance Meter™*

Measure antenna resonant frequencies and 2:1 SWR bandwidths. Adjust mobile antennas, antenna tuners and matching networks in seconds.

Measure RF resistance, inductance, capacitance, resonant frequency of tuned circuits, transmission line velocity factor /impedance/ loss. Test RF chokes,baluns.

MFJ-209, $109.95, same as MFJ-259 less frequency counter and *RF Resistance Meter™*

See *free* MFJ catalog for complete line of MFJ SWR Analyzers™.

MFJ-949E 300 W Tuner

MFJ-949E **$149.95**

World's most popular antenna tuner covers 1.8-30 MHz, has lighted *peak/* average Cross- Needle SWR/ wattmeter, 4:1 balun for balanced lines and *full size* 300 watt dummy load.

Versatile 8 position antenna switch lets you *pre-tune* MFJ-949E into dummy load to minimize QRM.

Custom inductor switch was carefully engineered to withstand extreme voltages and currents.

Cabinet is chemically etched to MFJ's bond tough *baked-on* paint.

VHF/HF Packet TNCs

MFJ-1270C **$119.95**

MFJ-1270C *super* TAPR TNC clone has a world wide reputation as *the most reliable packet TNC in the world* -- many work 24 hours a day for years without a single failure!

Fully TAPR TNC-2 compatible, VHF *and* HF operation, *free* AC power supply, new *enchanced* mailbox expandable to 512K with auto/reverse mail forwarding, WeFAX mode lets you print weather maps, optional plug-in 2400/9600 baud modems, KISS interface, ***now GPS compatible.***

MFJ TNC/Mic Switch

MFJ-1272B **$39.95**

Switch between your TNC or microphone by pushing a button!

Just plug pre-wired cables into your rig's mic connector and TNC.

Plug-in jumpers let you use nearly any rig with 8 pin mic connector.

MFJ-1272B/MFJ/TAPR TNC2 clones;
MFJ-1272BX/PK-232;
MFJ-1272BYV/KAM VHF/KPC3;
MFJ-1272BYH/KAM HF Port;
MFJ-1272BZ/PK-88, $39.95 each.
For 8 pin RJ45 modular phone jack replace B with M in model number above.

Regenerative RCVR Kit

MFJ-8100K **$59.95***kit*
MFJ-8100W **$79.95***wired*

Build this *regenerative* shortwave receiver *kit* and listen to shortwave signals from all over the world with just a 10 foot wire antenna.

Has RF stage, vernier reduction drive, smooth regeneration, five bands.

MFJ-1278B Multi-Mode Data Controller

MFJ-1278B **$299.95**

Use this MFJ-1278B, your transceiver and computer to transmit and receive digital communications! You'll discover a whole new world of ham radio and communicate in ways you never knew existed on our ham bands.

The *world class* MFJ-1278B Multi-Mode and MultiCom™ software is packed with features *no other* multi-mode gives you.

You get *10 digital modes* . . . Packet, AMTOR, PACTOR (at no extra cost), RTTY, ASCII, Navtex, Color SSTV, 16 Gray Level FAX, CW and Memory Keyer plus an *enchanced* 32K Mailbox.

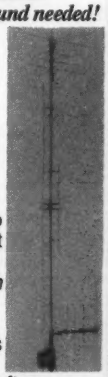
You'll have fun joining worldwide *packet* networks and exchanging *color SSTV* pictures with your buddies around the world. You'll marvel at *full color FAX* news photos as they come to life on your screen. You'll see weather changes on highy detailed *weather maps* in all 16 gray levels. You'll eavesdrop on late breaking news as it happens on *RTTY*. You'll enjoy error free HF QSOs on *PACTOR* and *AMTOR* and receiving packet mail in an *enchanced 32K mailbox*. Want to copy some *CW*? Just watch your screen.

MFJ-1289, $59.95, MultiCom™ software and cables.

MFJ *halfwave vertical* Antenna

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed!

MFJ-1796 **$199.95**



Operate 6 bands -- 40, 20, 15, 10, 6 and 2 Meters --with this MFJ-1796 *ground independent* halfwave vertical antenna! No radials or ground ever needed!

It's only 12 feet high and has a *tiny* 24 inch footprint! You can mount it anywhere from ground level to the top of a tower -- on apartments, condos, small lots, even on motorhomes. Perfect for vacations, field day, DX- pedition, camping.

Frequency selection is fully automatic -- all you do is transmit. Its *low angle of radiation* really reachs out and brings in DX. Omni-directional. 1500 watts PEP.

Efficient *end loading*, no lossy traps. *Entire length* is always radiating. *Full size* halfwave on 2 and 6 Meters. High power *air-wound* choke balun eliminates feedline radiation. Adjusting one band has minimum effect on other bands. Add $20 s/h.

Easy to assemble -- you'll have it on the air in an afternoon.

MFJ's *world famous* 3 KW Versa Tuner V

MFJ-989C **$349.95**

Here's why the MFJ-989C is the finest 3 KW antenna tuner money can buy . . .

Two *massive* 250 pf transmitting variable capacitors can handle *amps* of RF current and *6000* RF volts. Logging scales.

MFJ's exclusive heavy duty *AirCore™* Roller Inductor has an air core--it can't burn up! Get high-Q, low loss & exact inductance control.

Lighted *peak*/average Cross-Needle SWR/Wattmeter has 200/2000 watt ranges. Super heavy duty *current* balun has two giant 2½ inch powder iron toroid cores wound with *Teflon®* wire.

Six position *ceramic* antenna switch has extra large contacts. Flip stand, dummy load, one year *unconditional* guarantee, aluminum cabinet, tough *baked-on* paint, locking compound on nuts/bolts, handles 3 KW PEP, 10⅛x4½x15 in. Meter lamp needs 12 volts. Add $13 s/h.

MFJ *No Matter What*™ Guarantee

MFJ's famous one year ***No Matter What™*** *unconditional* guarantee means we will repair or replace (at our option) your MFJ product sold in this ad *no matter what* for a full year.

Super Hi-Q Loop Antenna

MFJ-1786 **$299.95**

Tiny 36 inch diameter high efficiency loop antenna covers 10-30 MHz *continuously* with low SWR. Handles 150 watts.

Ideal for home installations where space is limited-- apartments, condos, small lots. Take on trips.

All welded construction.

Remote control has *Automatic Band Selection™*, Cross-Needle SWR/ Wattmeter. No control cable needed. Use batteries or 110 VAC. Add$20 s/h.

No ground or tuner needed.

MFJ-1782, $269.95, like MFJ-1786 but remote control has only slow/fast tune buttons.

Dual Band Mobile Ant.

Mobile Antenna for 144/440 MHz

MFJ-1724B **$14.95**

MFJ *dual band* magnet mount mobile antenna for 144/440 MHz has 19 inch stainless steel radiator, low SWR. For mobile rigs with SO-239 UHF connector *and* handie-talkies with *included* BNC adapter.

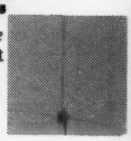
5/8 Wave Mobile Ant.

MFJ-1728B **$24.95**

Maximum Gain™ 5/8 Wave 2 Meter *magnet mount* mobile antenna has stainless steel radiator, 12 ft coax, low SWR.For mobile rigs with SO-239 UHF connector *and* handie-talkies with *included* BNC adapter.

5/8 Wave Ground Plane

MFJ-1750 **$19.95**



$19.95 gets you a 2 Meter 5/8 wave ground plane *home station* antenna! You get the highest gain of any single element antenna, shunt fed matching, ceramic insulators.

MFJ-1752, $19.95, for 220 MHz.

Free MFJ Catalog

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also handles and sorts operator messages, bulletins, and status packets onto separate display screens.

The utility of the APRS map displays should be obvious to anyone who has analyzed typical special event traffic. One of the greatest real-time needs at any special event or emergency is the tracking of key people. Where is the event leader? Where are the emergency vehicles? What's the weather at various points in the county? Where are the power lines down? Where is the head of the parade? Where are the VIPs? Where is the mobile ATV camera? Where is the hurricane? Where is the DX?

Unconnected broadcast packets

Another advantage of APRS over conventional packet is that it avoids the complexity and limitations of making connections to each station. APRS sends information as broadcast packets that permit any number of stations to exchange data, just like voice users would on a voice net. Any station with information to contribute simply sends it, and all stations receive and log it. To assure delivery to all stations, APRS packets are repeated periodically. After each transmission, the period to the next transmission is doubled so that older information is given lower priority than newer information.

Generic digipeater routing

An APRS operator needs no prior knowledge of the network to copy and send packets, because APRS takes advantage of the capability of any TNC at any station to serve as a relay for other stations. All APRS stations are initialized with the generic second callsign (alias) of RELAY so that any station can always get a packet out just by sending it via RELAY, or RELAY, RELAY. After monitoring an APRS channel for 10 minutes, every APRS station and digipeater will probably have appeared on his map. Using this visual geographic information, the user can then use more creative and specific routes for his intended area of interest. Similarly, all WIDE area APRS digipeaters are given the generic alias of WIDE and a second alias of RELAY. The typical path for a mobile is to use the path via RELAY, WIDE so that he is digipeated whether he is in range of a WIDE (RELAY) or any other APRS station. This usually suffices for typical radio nets.

"You can zoom in to any point on the globe!"

Applications

Although APRS was initially designed for tracking moving vehicles, it soon found applications in all facets of amateur radio. Any communications concerned with the location of anything can be tracked with APRS: SKYWARN; weather nets; hurricane tracking; both manual and automatic direction finding; plotting satellite contacts; monitoring DX packet clusters and plotting all DX spots automatically; marathon and other event tracking; plotting all stations on all frequencies for frequency coordinators; Meteor Scatter using the very short APRS packets; HF beacons (lets you see where the band is open); vehicle tracking; balloon tracking; Civil Air Patrol search and rescue; Coast Guard Auxiliary search and rescue; and frequency coordination are only a few possibilities.

Besides the map displays, there are many other display pages that collect information from packets on the channel. These displays give instant access to all the data in the network as follows:

•Latest Status: This display maintains a list of the latest status packet from each station. In effect, this is a multi-station online broadcast message

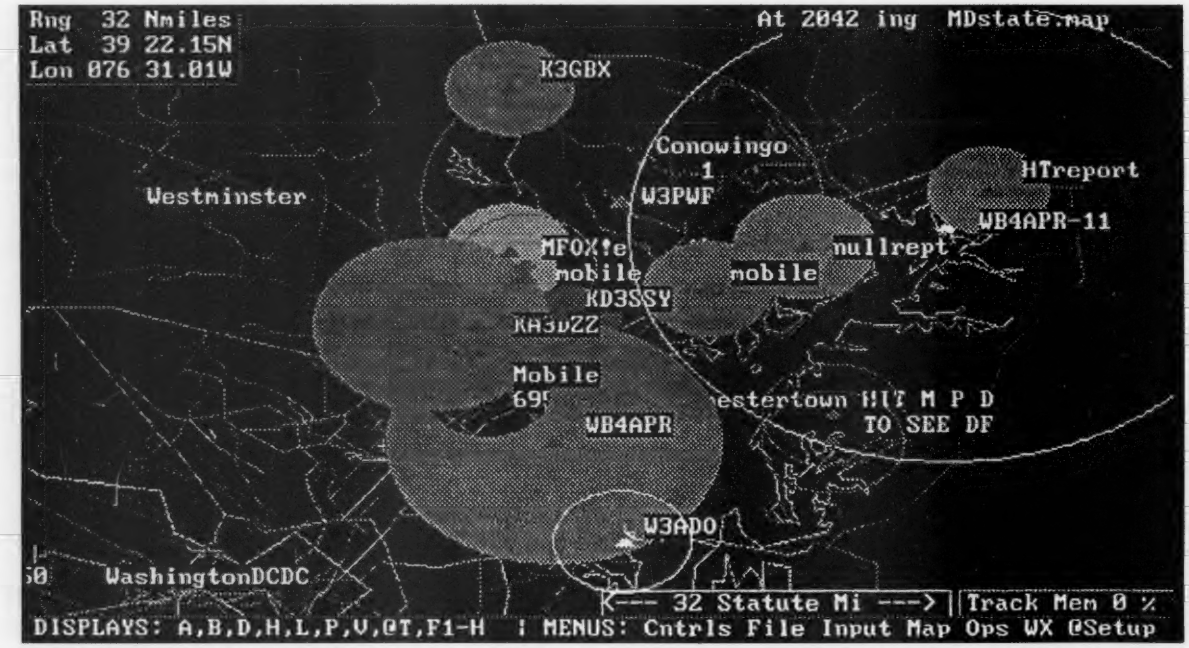

***Photo B**. APRS permits Direction Finding using only signal strength. Even null reports are very valuable in showing all the locations where the fox is* not. *Brighter colored circles show increasing signal strength and gray circles show the null reports. The fox will be near the intersection of the brightest colored circles.*

NEVER SAY DIE

Continued from page 4

Now, pundits, how do you explain all that, and what do you see (if any) as ramifications?

And there you have it. Advanced grew at an average of 1.9% per year, which does look like growth until you figure out that around 3% are dying per year, mostly due to poor nutrition (Americans have one of the worst diets in the world) or smoking. Generals grew at less than 1% per year. Novices at 1.3%. Ho hum.

Congress Messing Up Again

Big surprise, right? Naturally, instead of tackling the source of the TVI (etc.) problem, which is the wide-open design of TV sets' front ends and the lack of RF bypassing on telephones and hi-fi systems by the manufacturers, Coingress (not a typo) is trying to put through a new law which would enable the states to close down interfering transmitters. Well, Congress (is con-gress the opposite of pro-gress?) has steadily cut the FCC's funds so they are impotent to cope with the problem, and the FCC, fought vigorously by lobbyists, has never been able to get the manufacturers to improve their equipment, so the Commission has had to pretty much just ignore the cries of distressed consumers.

Yes, some of the trouble stems from overpowered CB equipment. Being illegal, their high power amplifiers don't have to meet any regulations, so they're terribly dirty. But the design of TVs and other consumer electronics equipment is such that even a legal CB transmitter is likely to raise hob with the neighbors.

And with the proliferation of transmitters as two-way communications expands exponentially, and with no hams on our state legislatures to help protect us from really stupid state laws being passed, if this doozie (S.2025) goes through we could get put off the air by our local authorities, who won't know a ham rig from a CB. If whatever you're doing interferes with that $199 TV next door, then shut it down. Or else.

Not content with having made our school system worse than most third-world nations (and by far the most expensive in the world); not content with having made our so-called health care system a ridiculously over-priced mess; not content with having spent more of your money on their "war on poverty" than it would have cost to buy all the Fortune 500 companies, plus every farm in America, with no detectable positive effect; not content with their totally lost drug war which has been primarily instrumental in the spread of cocaine and crack; now they've got us in their sights. Maybe we need another ham lobbyist in Washington with no budget to bribe our betters. Well, you can bet that the electronics equipment manufacturers lobbyists are there, and armed with whatever it takes. When money changes hands, no matter the rationalization, that Congressman is then acting as a paid agent.

Continued on page 19

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system. In DX cluster mode, it accumulates a list of all users and their latest commands to the cluster.

•Positions: This display shows the text of the position reports. They are time-stamped and may include brief comments. These reports may also contain DF or WX information. In DX mode, this list contains the positions of all DX spots and user locations heard.

•Maps: Maps from 100 yards up to 8,000 miles can be displayed, showing the positions of all stations. Stations reporting a course and speed are dead-reckoned to their present estimated position. Databases of most National Weather Service stations and the Civil Air Patrol search and rescue grid are built in. You can zoom in to any point on the globe! Megabytes of maps are available for APRS and more are made every day. Using the US Geological Survey $32 CD-ROMs, you can make a street level APRS map in about an hour.

•Messages: This display shows the last page of operator messages to and from your station. Incoming messages are immediately brought to the operator's attention.

•Bulletins: This screen displays all bulletins captured. They allow one station to send multiple lines to all stations.

•Traffic: This screen shows the last page of messages exchanged between other stations on the net. It is useful for "reading the mail." DX packet cluster talk traffic also shows up here.

•Heard log: This display maintains a count of the total number of transmissions from each station per hour. These statistics are ideal for displaying the connectivity of the network over varying paths, such as HF, or to see when stations enter and leave the net. On HF, this display can show propagation conditions to all areas at all times.

•Digipeater list: This display shows the raw packet header so that APRS users can see what digipeater paths are being used by other stations. The proper use of digipeaters is important in an APRS network. An asterisk in the first column means that you hear the other station direct without a digipeater! Change your UNPROTO path to NONE to chat with those stations. In DX mode, this list accumulates a list of all DX packet cluster messages heard.

•Telemetry page: This page displays the last 16 telemetry packets received. The APRS telemetry format allows for five analog channels and eight digital status bits. A complete APRS telemetry transmitter the size of a matchbox (with 1-watt xmtr!) is available for under $200.

"GPS trackers have been installed in a football helmet, a model of the Olympic torch, and even on cows! With the advent of GPS, everything can be tracked!"

APRS mobile vehicle location system for voice nets

APRS is almost universal, so many applications are moving off the purely digital channels and into voice networks. Since a position or object report is only a single one-second burst, many nets permit the packets on their voice channels to inform all stations of their locations. The Navy MARS program has used APRS for years on their HF afloat net. Although the military ships never report their position, the periodic position reports from the shore stations are like an automatic HF chirp sounder. The ships just leave APRS monitoring the voice phone patch channel, and they can see

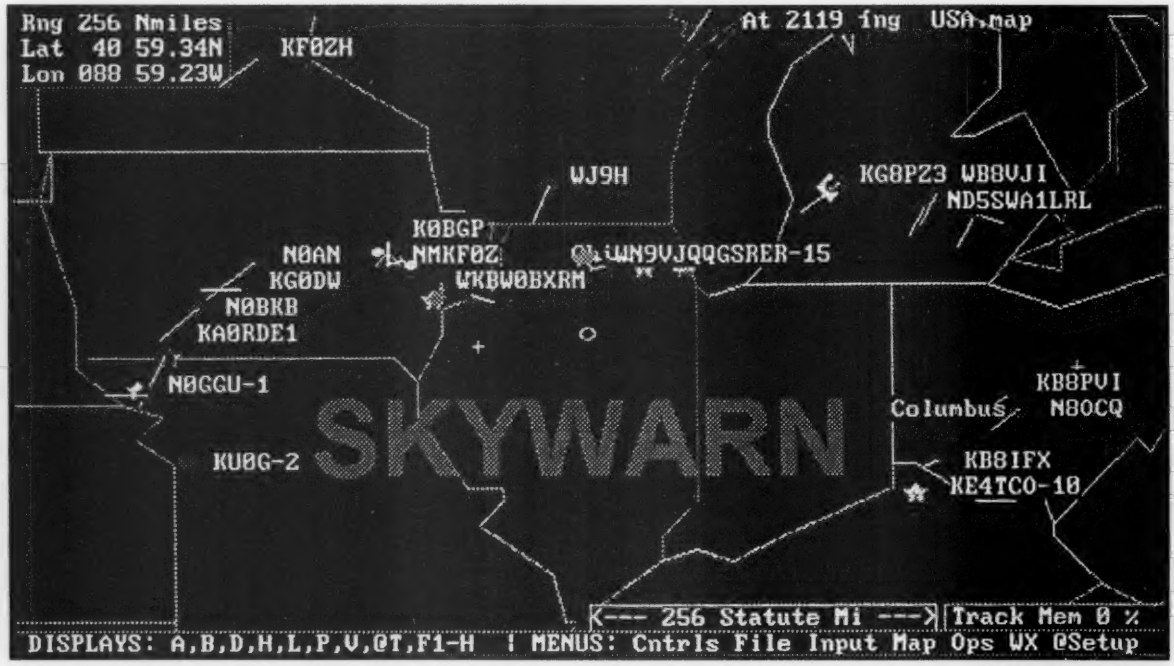

***Photo C**. Not only does APRS show the location of all SKYWARN weather spotters, it can also show dozens of special WX symbols and even dead-reckon the movement of the storms being tracked.*

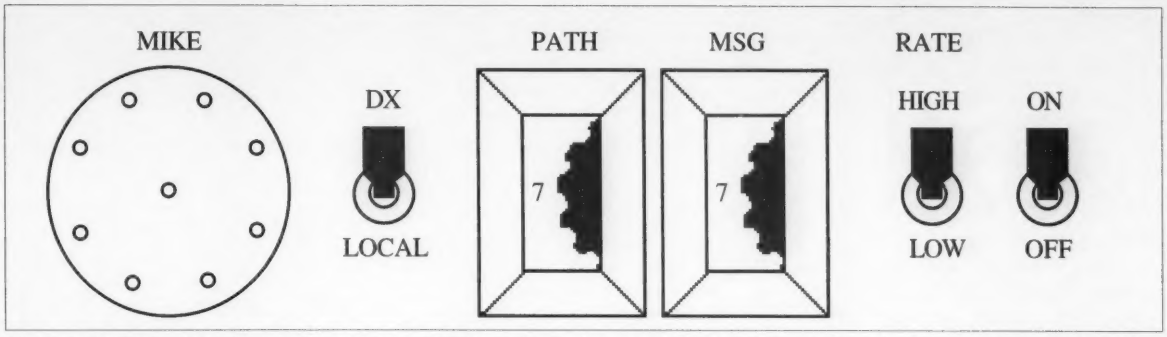

Fig. 1. The PATH thumbwheel switch gives 4 bits of routing information, and the second thumbwheel switch allows the operator to select one of seven predefined messages on the front panel of the APRS mike encoder. The rate switch allows the operator to select the high rate for frequent reporting and a four-times-lower rate for benign operations. The mike encoder is available from the Tucson Amateur Packet Radio (TAPR) Organization: @tapr.org.

on their maps at a glance what shore stations are monitoring and where the band is open, without having to make tedious voice call-ups. Not only do active stations show on the map, but the HEARD screen shows how many packets, per station, per hour, have been received.

APRS mike encoder

Recognizing the move towards automatic position reporting for all mobiles, the APRS mike encoder was designed to provide mobile position reporting without the requirement for a TNC, and additional radio and antenna. The APRS mike encoder appends a very short 0.3-second position tone burst on the end of your voice transmission, allowing automatic vehicle tracking in any vehicle with a two-way radio! The mike encoder is just a black box on your dashboard that plugs into the mike jack of any radio. A GPS and your mike plug into it, as shown in **Fig. 1**. It has a number of front panel switches to select any one of seven status messages, and to select various paths for your position report to take.

This mixing of voice and packet can be made totally transparent to the users on a properly configured repeater. Since the packet is only 0.3 seconds long, a TNC at the repeater site detects the packet on the repeater input and instantly mutes the repeater output so none of the voice users hear it. This 0.3 seconds is minimal compared to the typical one-second courtesy beep found on most modern repeaters. So where does the position report go? The TNC digipeats it not onto the repeater voice channel, but onto the local wide area digital APRS tracking channel. Since all position reports on all frequencies are digipeated onto this single APRS digital channel, stations monitoring the APRS frequency will be able to keep track of *all* mobiles on *all* frequencies!

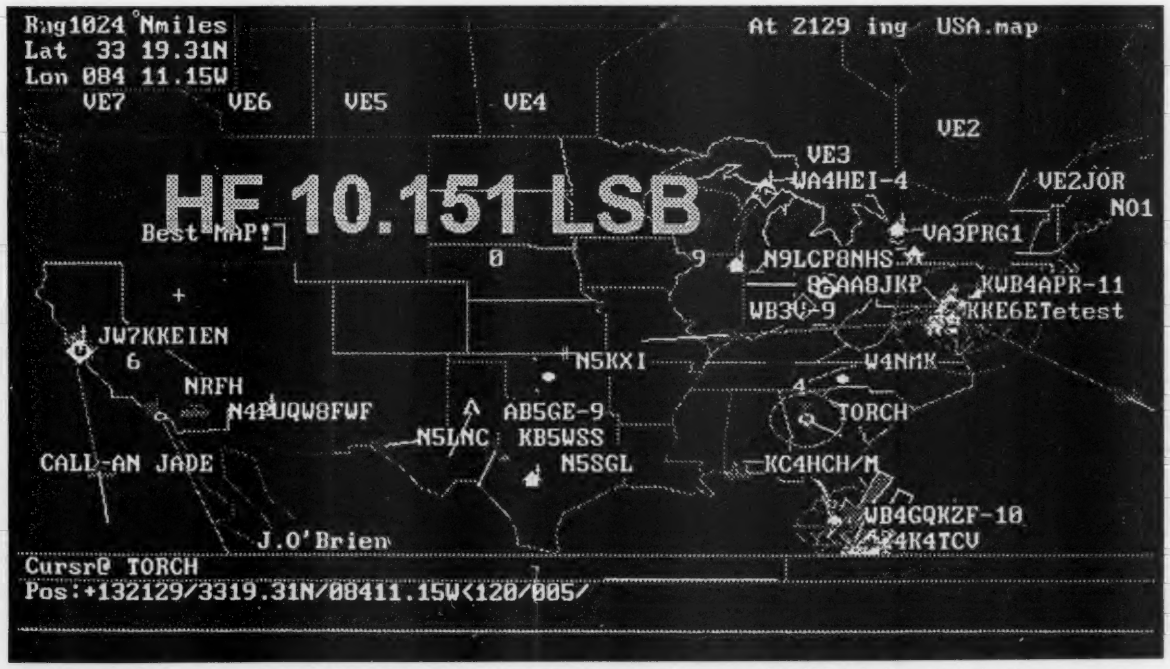

***Photo D.** This display shows the typical activity on the National APRS tracking frequency of 10.151 LSB. If you look closely you can see mobiles, including the Olympic Torch, among the numerous station and WX reports.*

Routing path

Since the object of the APRS mike encoder is to encode the position into the shortest possible packet, the long list of digipeater callsigns are eliminated. In their place are only 4 bits which allow for local and longer distance reporting, omni or directional, and provision to control the direction of propagation (see **Fig. 2**). The TNC at the voice repeater is a special APRS TNC that recognizes these bits as routing information and regenerates the packet by re-inserting the appropriate digipeater callsigns as needed to represent the indicated path. To do this the TNC has five special directional UNPROTO paths pre-loaded with the appropriate north, south, east, west, and omni paths. If the omni bit is set, then the TNC will digipeat the position reports via the single callsign WIDE-N, where N is the lower 3 bits of the original SSID. This path will radiate outward in all directions with no duplicates since each properly configured WIDE digipeater will repeat it only once and decrement the -N by one. This specialized routing algorithm is called the WIDE-N algorithm and requires that the digipeater maintain a copy of the last minute's worth of packets so that it can compare and avoid duplicating a packet that it has already sent. Until the new special APRS Voice Repeater TNC is installed at all repeaters, the APRS mike encoder can operate with the full digipeater UNPROTO path in its transmitted

```
x x x x }—The four routing bits.
| | | |
| | *-*——These two bits represents the number of hops if omni
| | or four directions if directional: NORTH = 11
| | EAST = 01
| | SOUTH = 10
| | WEST = 00
| |
| *———A 1 here indicates LONG DISTANCE vs LOCAL
|
*———A 1 here indicates an OMNI vs a DIRECTIONAL PATH
```

Fig. 2. APRS mike encoder routing bits. A special APRS TNC at the repeater site decodes this information and sends the packet in the appropriate direction.

***Photo E.** This APRS display was saved during the Space Shuttle SPRE mission in January 1996. In this experiment, the payload built by students at the University of Maryland beaconed its own GPS position.*

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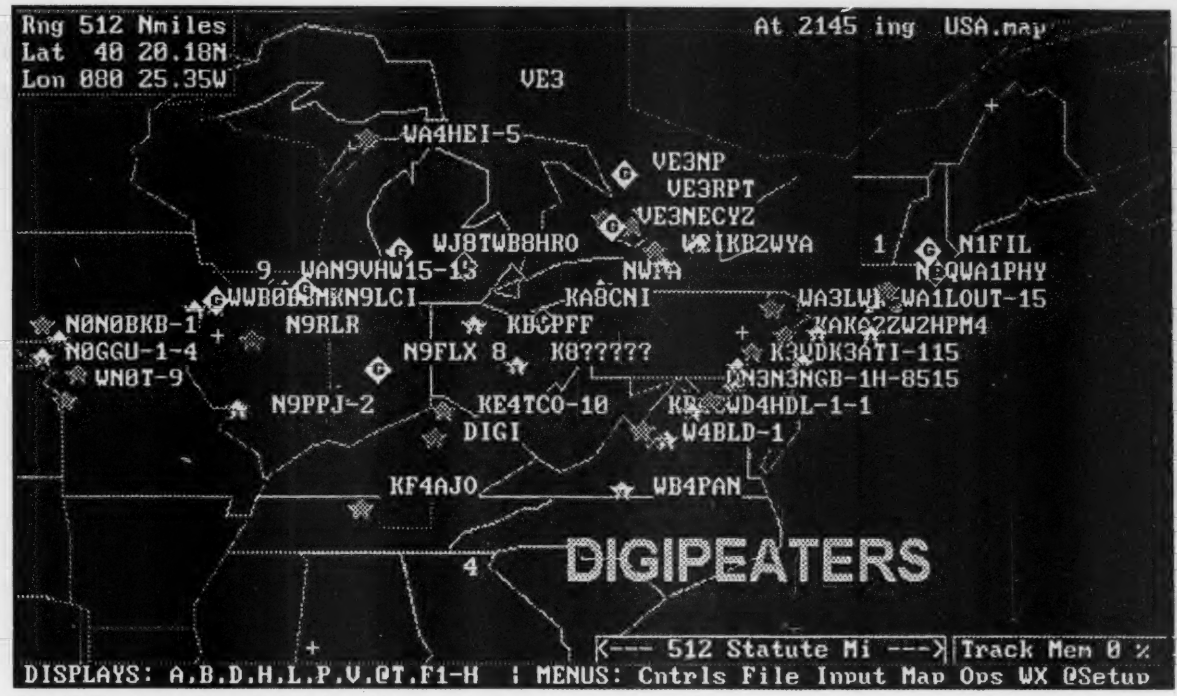

***Photo F**. This display shows all of the APRS WIDE area digipeaters in the northeast. There are comparable numbers in the west and southeast.*

packets. The only shortcoming is that these packets are longer, up to 0.6 second long.

Station tracking

Although APRS automatically tracks mobile packet stations interfaced to GPS or LORAN navigation, it also tracks perfectly well with manual reports or grid squares. Additionally, any station can place an object on its map, including itself, and within seconds that object appears on all other station displays. In the example of a parade, as each checkpoint with packet comes on line, its position is instantly displayed to all in the net. Whenever a station moves, he just updates his position on his map and that movement is transmitted to all other stations. To track other event assets, only one packet operator needs to monitor voice traffic to hear where things are. As he maintains the positions and movements of all assets on his screen, all other screens running APRS software display the same maps. There is also a tracking command on the P display that will cause APRS to keep the map display always centered on a selected object.

Automatic event tracking

For predictable events such as marathons and other races (even the running of the Olympic Torch), there is a version of APRS called APRSdr that can automatically dead-reckon any number of objects along a given map course. Just place the symbols on the course, give them a speed, and APRSdr will move them along the course and transmit their new positions every N seconds to everyone on the net. For marathons, just give the leader a speed of 9 knots and Tail-end Charley a speed of 3 knots and you don't even need GPS! If the symbols get ahead or behind, simply select them with the cursor and move them to where they are. Using APRSdr in this manner frees up your limited number of GPS trackers for those assets that are not predictable, such as race officials and service vehicles.

"APRS users can set weather alarms and be alerted when conditions exceed given values."

Using APRS position reports on all packet stations

APRS can be used to monitor any packet frequency to collect information on other stations on that channel. As more and more networks include the position of all key assets in their ID packets, APRS can be used as a general purpose network topology display on any packet frequency! Even if the positions are manually entered onto an APRS map, such APRS backup files make an excellent mechanism for distributing frequency usage information in an easily maintained map format. Since APRS captures only beacons, it is a great tool for monitoring the activity of a busy packet channel. Just monitor for an evening, and APRS will identify all stations on frequency and capture their beacon text and/or ID packets. This is a great way to locate all packet stations on a frequency.

Space applications

The problem with space packet is the saturation on the uplink by hundreds of stations which makes the use

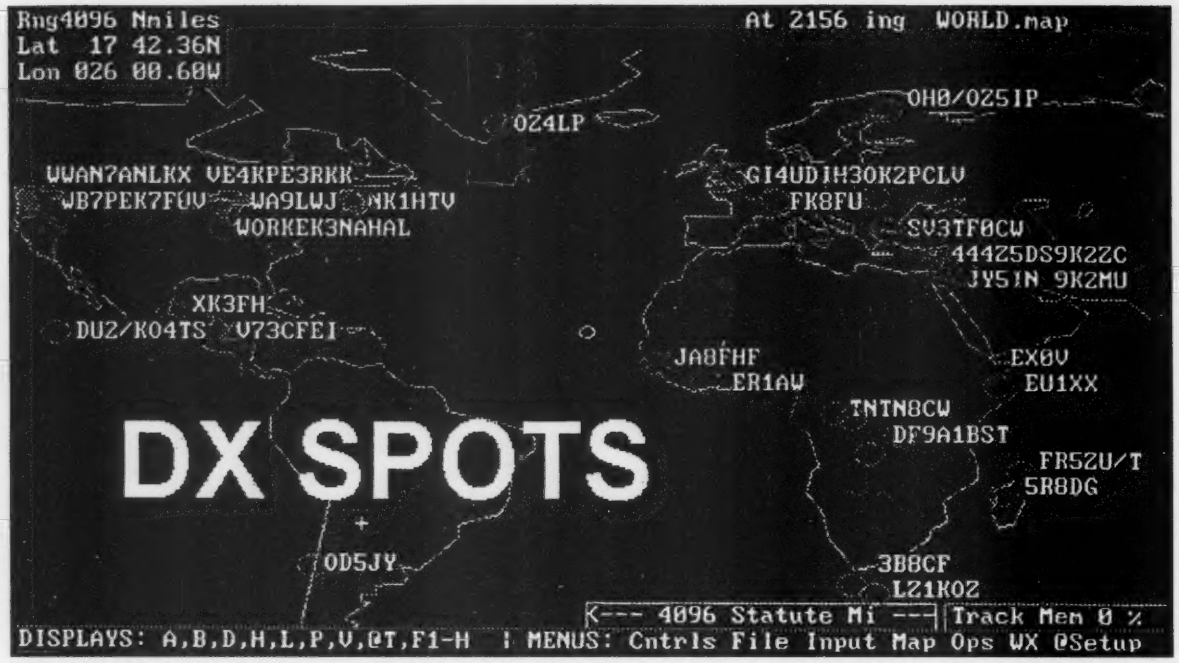

***Photo G.** APRS will plot the positions of all DX spots and grid squares that it monitors on the local DX cluster. It also gathers a list of all users and all messages posted on the cluster just by monitoring the frequency.*

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of a normal "connected" protocol impractical. The shortest possible "connected" contact requires a total of five successive and successful packets. APRS reduces this to one packet, and also capitalizes on the most fascinating aspect of the amateur radio hobby—the map display of the location of those stations.

A special version of APRS called "APRtrak" was donated to the AMSAT software library. It will compress your position report to only six letters using the Maidenhead grid square and transmit that in the TO address field of a very short packet. Similarly, it will plot any such stations heard. If everyone used APRtrak instead of trying to connect with orbiting packet digipeaters such as SAREX, then everyone within the satellite footprint would see the location of every successful uplink. In January 1995, during mission STS-72, students at the University of Maryland built a 2 meter digipeater called SPRE that flew for 18 hours from the Space Shuttle. During those brief 18 hours (with only three low passes over the southeastern USA between midnight and 3:00 AM) more than 70 stations were plotted.

Currently APRS position reporting via satellite experiments are being conducted on the amateur WEBERSAT WO-18 which has a 2 meter uplink and 437 MHz downlink. Although the downlink requires special PSK modems, the uplink can use a standard FM radio and modified TNC.

Fox hunting or direction finding

APRS will plot the location of a hidden transmitter, balloon, or interfering signal, and display the intersection of bearing lines from a number of reporting stations, and overlapping signal strength contours, if only signal strengths are reported. Finally, APRS includes the Fade-Circle Search and Rescue technique which can be used by a mobile with only an omni antenna to locate a hidden transmitter.

To use APRS for DFing, each station having a bearing report or a signal strength on the target simply enters that bearing, using the OPS-DF command. His station will then not only report his location, but also a line of bearing or signal strength contour. All stations running APRS will see any reported DF bearing lines and overlapping signal strength contours on their maps. Even with signal strengths alone (which anyone with *any* radio can report), the location of the signal can be

isolated down to a few miles or neighborhood. Further, APRS can track any DF vehicles using GPS or LORAN devices. There is an optional Doppler DF registration for direct connection to any of the Doppler DF units for automatically plotting and transmitting instantaneous DF bearings.

Weather station reporting

APRS position reports can include wind speed and direction, as well as other important weather conditions. APRS supports an optional serial interface to the ULTIMETER-II, Davis and WeatherMax home weather stations. With this interface, your station includes weather conditions in your position report for display at all other stations in the network. All weather stations show up as a bright blue circle, with a line indicating wind speed and direction. The NEXT command in APRS will successively highlight each

"This is a benefit to everyone on the channel."

weather station in turn, so that all reports can be collected at a glance. Optionally, the temperature, barometer, and wind speed can be shown next to each weather station instead of their callsigns. APRS also has a database of the locations of most National Weather Service (NOAA) sites for instant display, and can crunch a file of NOAA hourly WX conditions, and update all NOAA stations on the map. Finally, APRS users can set weather alarms and be alerted when conditions exceed given values.

DX packet clusters

The positional display and real-time user communications make APRS an ideal tool for the DX cluster user. Not only does he get to see all DX spots on the map at the instant they are transmitted to even the first cluster user, but by operating in the "monitor only" mode, he has reduced the overall packet load on the DX cluster. This is a benefit to everyone on the channel. Also, the APRS monitoring station will see the spot as soon as the first station gets it.

Frequency coordination

More and more BBSs, digipeaters, and nodes are including APRS position information in their routine beacons. If the frequency coordinating body makes available APRS backup files (or HST files) showing the positions of all coordinated services, both packet and voice, then these files can be distributed on BBSs and by other means to all hams in the area. By loading these files, users can instantly see the established frequency users in a geographical setting. Add the ability of APRS to plot crude range ring contours based on antenna height and gain to this visual reference, and you can see that APRS is useful for displaying the topology of any network, and the interference ranges of voice repeaters.

To date, APRS has been used at numerous marathons, walkathons, and special events. It has been installed on ships, boats, airplanes, and balloons. GPS trackers have been installed in a football helmet, a model of the Olympic torch, and even on cows! With the advent of GPS, everything can be tracked! This year, over 50 APRS mobiles showed up at Dayton and could be tracked all over the state.

APRSdos, MacAPRS and WinAPRS are available as shareware on most ham radio bulletin board systems. There is also an APRS special interest group on the Internet. Send a message to listproc@tapr.org and include the words "subscribe aprssig" in the body of the message. You may download these APRS programs via FTP from tapr.org in the tapr/SIG/aprssig/files directory.

Registration of these programs is $29 for APRS, $50 for Mac and $60 for WinAPRS.

APRSdos Registrations: Bob Bruninga WB4APR, 115 Old Farm CT, Glen Burnie MD 21060.

MacAPRS Registrations: Keith Sproul WU2Z, 698 Magnolia Road, N. Brunswick NJ 08902.

WinAPRS Registrations: Mark Sproul KB2ICI, 698 Magnolia Road, N. Brunswick NJ 08902. 73

NEVER SAY DIE

Continued from page 13

Maybe you've read about the Congressmen who call industry associations and threaten hearings unless they get money for their re-election campaigns? Oh yes, I forgot, you're too busy to read books. Besides, what can one person do, right?

Search For Intelligent Life Fails!

The $1.5 trillion (this year) search for intelligent life in Washington has totally failed. No problem, more money has been budgeted for next year. The IRS has assured us that we taxpayers will be in compliance to cover this continuing search. As Congressmen have explained about the deficit, "Heck, any business has to carry some debt. And after all, it's only a paper debt anyway. The continued foreign support of our debt means they have confidence in America. Well, we want them to have even more confidence."

Opinions

There's a big difference between expressing opinions vs. being opinionated. I enjoy hearing from readers who have opinions which are backed by solid homework. One of the problems with the Internet is the abundance of opinionated blather. Not that we don't have much of the same on some 75m nets. And that reminds me, I heard Herb KV4FZ pounding through on 20m the other morning. What does it take to get the FCC to delicense someone?

Dennis Lee

Several readers have asked me what I think of Dennis Lee and his cheap power inventions. I haven't gone to any of his demonstration/sales sessions, but I have seen his video and read his book. The book is not going to make my list of books you're crazy if you don't read. It's more a candidate for books you're crazy if you bother to read.

Here's a guy, a showman, obviously, who claims he has a great invention. It'll generate power and heat your home, making you free of the power company. It'll run your car. And so on. His book tells nothing at all about the technology. It's mainly a history of his persecution by the government and the courts, and the time he had to spend in prison. Now, I'm not used to the notion that our courts and government are right about much, but this time maybe they weren't out as far in left field as usual.

Having watched most of the big-time magicians both in person and on TV, I'm used to the idea that a good magician can make almost anything seem to happen. So the more I watched Lee's video, the more I felt I was watching a magic act, not a scientific demonstration.

I was surprised when I read that Yul Brown (Brown's Gas) would be appearing with Dennis at Philadelphia. I've watched a video of a Brown's Gas demonstration, but I didn't understand the theory of what was

Continued on page 23

73 Review

The Ten-Tec 1209 2-to-6 Transverter

An easy way to have some fun!

David McWhinnie VA3XDM (ex VY1DM)
281 Castor St.
Russell, Ontario
Canada K4R 1B8

If you are looking for a way to jump into the fun on 6m, the modestly priced Ten-Tec 1209 2-to-6m Transverter may be just the answer. Available either as a kit or pre-built, this transverter provides an easy route to the entire 6m (50-54 MHz) amateur band, using just a 2m transceiver. Providing access to a whole new set of FM repeaters, the unit is also a great way for Technician Class operators to get in on the fun of working DX openings, especially when used with a 2m all-mode transceiver. Add the pride that comes from using something you put together yourself, and this kit really has it all!

Construction is not difficult, requiring only basic hand and soldering tools, with an ordinary multimeter and some kind of power output meter being the only test equipment needed. I found that a simple HF SWR/power meter worked just fine.

At just under $100 US for the kit ($159 pre-built), you can have hours of operating fun for a modest sum, as well as the pride of using something you had a part in building.

Technical

Technically, the Ten-Tec 1209 is straightforward, comprised of a 94 MHz local oscillator and diode mixer to convert 2m signals to 6m (and vice versa), amplification and filter circuits, and PIN diodes for T/R switching. The T/R circuit is RF sensing, so the radio's antenna connector provides the only connection between radio and transverter. No modifications to your radio are required. The assembly manual does strongly emphasize the importance of correctly assembling and testing this portion of the kit, which ensures proper operation of the transverter and prevents unwanted/spurious output signals.

"The unit produced close to 10 watts at the center of the band, and easily managed better than 9 watts almost to the edges of the band."

With a maximum driving power of 5 watts, this transverter produces 8 watts at 6m, making it ideal for use with most 2m handhelds. As most synthesized 2m rigs are user-programmable to handle TX/RX frequency offsets other than the standard 2m split of 600 kHz, the common 6m repeater offset of 1 MHz is easily managed. Should you have a 2m rig which cannot readily be set to 5 watts maximum output, Ten-Tec has thoughtfully included instructions on the necessary modifications to the input circuit to accommodate both higher and lower input powers.

After construction, I tested the unit using a commercial service monitor and found that it met or exceeded Ten-Tec's specifications. If anything, Tec-Tec seems to have been a bit conservative in describing the performance of their product. While Ten-Tec specifies a nominal output power of 8 watts (for the maximum 5 watts input), the unit produced close to 10 watts at the center of the band, and easily managed better than 9 watts almost to the edges of the band, only dropping off significantly at 54 MHz (the upper limit).

Input (6m) sensitivity was measured at .13V for a 20 dB S/N ratio (on FM), again slightly better than the nominal .15V specified. The assembly manual notes that this specification depends on the sensitivity of the 2m receiver used. In on-air use, the built-in preamp ensured that receive sensitivity was ample, with little or no noise noted.

Because of the inherent sensitivity of the 2m transceiver to its design frequencies, keeping unwanted 2m signals from "leaking through" and appearing in the 6m band is sometimes challenging. The 1209 meets this challenge well, with no feedthrough noted in on-air use.

The most noticeable thing on first unpacking the kit is its weight. Although it's only a little more than 7 inches (W) by 6 inches (D) by 1 inch (H), the assembled kit weighs about 2.5 lbs., largely due to the steel enclosure. If you've ever chased an aluminum box all over a table because it's too light to stay in place with the coax connected, you'll appreciate the physical stability of this little unit. As an aid to final testing and troubleshooting, the board can be temporarily installed upside down, which I found very handy. Mechanically, the cabinet, connectors and board (there's only one circuit board) fit well, and solidly. The finished product looks and feels substantial, and has none of the "second grade" feel sometimes associated with kit or home-brew equipment.

Construction

Assembly is not difficult, and would take most reasonably diligent hams between 10 and 20 hours, if my experience is any guide. The manual is well laid out, and is clearly geared for the inexperienced builder. Construction is organized into seven basic "phases," each encompassing a particular functional segment of the circuit. Each phase includes a step-by-step description of the assembly to be performed, a schematic and pictorial representations of the part of the circuit and board being constructed, and a concluding "progress test" to ensure that the steps have been completed correctly. I found this approach quite convenient, as the time required to complete and test an individual phase nicely fit the time available of an evening, once dinner was cleared, the kids bathed and read to, etc.

"Ten-Tec even provides a detailed description of each component to be installed at a given step."

The manual contains many helpful hints and suggestions in addition to the extremely detailed descriptions of each individual step. Ten-Tec even provides a detailed description of each component to be installed at a given step, i.e. "Install resistor R39, 10S (brown-black-black)." While this degree of detail might be unnecessary, having both the value and the "description" may serve as a second check on the builder's selection of a given part. To further aid installation, the topside of the board is printed with component numbers and outlines, showing the correct orientation of each component.

Those who like to "roll their own" will undoubtedly be glad to discover that there is some coil winding to be done. The instructions are clear and the illustrations helpful, so the task is readily managed, even by the less experienced.

The only quibbles I had with the construction phase were a couple of missing parts, and a hook-up wire which did not stand up well. When I opened the kit a couple of 10k resistors were missing (other value resistors somehow got into the package), as was a ferrite bead required for the lead of one transistor. As they are common items, I had them on hand. However, Ten-Tec makes provision for even this eventuality in the manual, and in their warranty they promise to replace any such missing parts promptly.

My only other quibble was a piece of hook-up wire which is installed early in the assembly process. The roll supplied in my kit was pre-tinned, and somewhat brittle. With the number of times the board has to be flipped over and back during the rest of the construction, this particular wire broke off several times. Annoying, but nothing serious.

On-air performance

Once the rig was checked out and tuned up, I hooked it up to a "quick and dirty" half-wave sloper dipole I had hung off my tower at about 15 feet, just to see if I could bring up the local 6m FM repeater. The repeater came up just fine, but no one was around to talk to, so I moved down to the sideband calling frequency (50.125) to have a listen. The first fellow I talked to, Bill K4LRX, turned out to be in Henderson, Kentucky, about 900 miles from my home QTH near Ottawa, Canada. I thought the 5 X 7 signal report was not bad for 10 watts, and a pretty poor antenna. I have since put up a home-brew three-element beam at 35 feet, and have had a fine time working stations up and down the East Coast, over to the Midwest, and when conditions permit, as far west as Oklahoma and Texas. The signal reports have been uniformly good, with many positive comments about how well this little rig does the job. Since I previously spent most of my time on packet and satellite, I'd never experienced the fun of (almost) QRP. There is a certain joy in discovering your home-brew 8W rig and three-element antenna is pulling in the same 5 and 9 signal report as your neighbor with 800 watts and six elements.

Conclusion

Obviously, I really enjoyed building this kit, and am having a ball using it on the air. Ten-Tec has done a good job with the kit itself, and I found them excellent to deal with when purchasing it. It happened that I had a couple of technical questions the salesman could not answer. Right away, I was put through to a technician, who had the answers and some helpful suggestions as well. This left a very favorable impression, and the performance of the kit has lived up to that impression. For someone looking for a reasonably low cost way to get on 6, and for an answer to some of those who dismiss "no-coders" as "appliance operators who can't build a thing," the Ten-Tec 1209 might just be the answer. It looks good, works well, and doesn't cost much. A good combination all 'round.

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Shooting Straight Up

NVIS: A neglected short-range technique.

Peter L. Barker XF1/KB6ASH
La Jolla de Los Cabos AB-506
San Jose del Cabo, B.C.S. 23400
Mexico

The quest for long distance communication has totally captured a large segment of the ham population, to the point where multi-element antennas at expensive heights are the sign of a serious ham.

"Forgo the kerchunking and give NVIS a try."

Few things in ham radio are more thrilling than a contact with some isolated island or far-off country, or the convenience of our thousands of repeater systems. But there are times when all the long-range antennas or slick little handhelds may just not be what is required. We are perhaps best known outside our own community for the communications we provide from disaster areas when all else fails. That is just the situation where Near Vertical Incidence Skywave operation may be the winning ticket—providing reliable short- to medium-range communication as required in a disaster, or even just for semi-local contacts in mountainous areas where it may be impossible to get into a repeater.

So how can you get involved with this type of operation? By using an antenna radiation pattern that is terrible for long-range DX but perfect for local coverage, even from the deepest canyon or behind the highest hill; and that is via high angle antenna radiation.

The reason antenna height is always stressed in DX antenna discussions, and why the big guns mortgage their family jewels to purchase those big towers, is the Holy Grail of low angle radiation. Within reason, the lower the angle of radiation, the greater the distance to the first reflection point in the ionosphere and the further away the touchdown point of the reflected signal. Fewer hops make for better DX. The downside is an almost total lack of signal in the nearby skipped zone. If we take the NVIS approach, we use the opposite effect. We want our signal to cover a circle around our location to a few hundred miles out. We, in fact, want our signal to take off as close to vertically as possible.

Signals that enter the ionosphere at a suitable frequency and a very high angle will be reflected back to earth around the transmitting point. The high takeoff angle allows the signal to ignore nearby high hills, and to get into (or out of) deep canyons or gorges.

Rarely discussed in ham literature, NVIS is a standard mode used by emergency and military communicators worldwide. It is very easy and inexpensive to do, and certainly deserves to be better known, especially by groups who pride themselves on emergency preparedness.

Using NVIS

For a fixed installation it could hardly be simpler. Rule One: Forget your verticals since they excel at low angle radiation and squirt almost nothing straight up. Rule Two: Keep it horizontal and relatively low.

A dipole is probably the simplest way to go. Cut it using the usual formula for the frequency of operation and mount it anywhere from 8 to 25 feet above the ground. It can actually work fine even lower than 8 feet, but might be hazardous—people walk into the wire, which can be surprisingly invisible to someone who's not paying attention. If you have to mount the ends of the antenna higher than 25 feet or so, you can go against everything that you've been taught and let the feed point sag well below the ends of the dipole. Try to keep the included angle greater than 90 degrees as you want to raise your takeoff angle but not cause cancellation of the signal.

So, how do I handle this on my mobile, where my antennas are normally vertical? This is more of a challenge since the antenna must be horizontal, but for someone with a little ingenuity it's no big deal. In this case a larger vehicle has an advantage over the mini-compact since it has more horizontal real estate with which to play. On an RV or truck, by using 10- to 20-inch lengths of PVC tube as standoff insulators it is possible to mount a respectable horizontal doublet, if not a full dipole. On smaller vehicles, two inexpensive loaded whip antennas will work fairly well when used as the two halves of a dipole. They need not be perfectly horizontal to be useful, so they can be mounted in an inverted "V" configuration. For multiband use, two "CB" type stainless steel or Fiberglas™ whips fed with a tuner with a balanced output can be used. The military makes extensive use of these, using megabuck helical loaded whips and automatic tuners.

The whole process relies upon the ionosphere directly above the

transmitter being reflective at the frequency of operation. As reliability is the main reason for using the NVIS mode, it tends to be used only on the lower frequencies, i.e. below 10 MHz. The rule of thumb is to use frequencies no higher than 90% of the MUF for the prevailing propagation conditions. At the present low level of sunspot activity, this means 160, 80 and 40 meters are going to be your bands of choice. The later in the day, the lower the frequency. Currently at night 160 and 80 meters will probably be the most usable bands.

NVIS has proven to be a reliable means of short- to medium-range communication and belongs in the repertoire of all emergency groups. It is simple to implement and an area which has been little explored. A few dollars' worth of wire and coax or a couple of inexpensive loaded whips will get you on the air, so forgo the kerchunking and give NVIS a try.

NEVER SAY DIE

Continued from page 19

happening. Well, maybe it's my stupidity, right?

So here's Lee putting on his show in cities all around the country, selling distributorships in his magical power unit, and, as far as I know, with no manufacturing facility anywhere, or even a preproduction model of his unit. That smelled fishy to me. And now he had Brown with him, claiming that he could de-activate radioactive waste. Hmm.

Lee claims that with his technology, cars can be modified (same engine) to run without gasoline and have no exhaust. His unit will purify an unlimited source of fresh water anywhere at no cost. Garbage and sewage can be disintegrated with no negative effects. Free electricity can be produced from air anywhere in any quantity. He has the world's greatest heat storage device, the world's most efficient heat pump, and frictionless oil.

René (author of *The Last Skeptic of Science*), who lives in New Jersey, went to the Philly demo/sales show, taking along some film to be exposed to the radioactive samples before and after the Brown treatment. I know you're not going to believe this, but Lee called off the radioactive demo and René was locked out of the hall.

When I first began hearing about Lee I was hoping that maybe somehow he was on to something. The book and video didn't help. And when I called his office they said there was no one there who could talk technically to me, and that Lee was on a national tour selling distributorships and wouldn't be back for several months.

I figured that if what he was doing made any scientific sense this could be another new technology that I might be able to help grow into an industry with a publication. Always looking.

Lee's Better World Technology works out of a post office box in a small northern New Jersey town which is less than 30 miles away from René's home. René says the talk up there is that Lee's group is planning on leaving town.

If you've read about the Lee inventions or seen them in operation, let me know what you think. Since what he is selling seems too good to be true, maybe it is.

Cancer Update

In the last 25 years, though billions have been spent on cancer research, the survival of about 97% of cancer victims has not been improved one little bit. Well, you ask, how about chemotherapy? What doctors don't want you to know is that chemo doesn't work except for a few very rare types of cancer. Worse, it can cause many more problems, including even more deadly cancers.

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Continued on page 27

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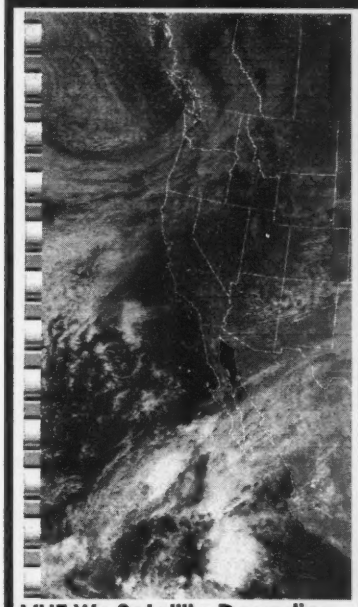

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Woodhouse Communications' APT-2CP Omnidirectional Antenna

... and its perfect sidekick, Hamtronics' LNG-137 receiver preamp.

Larry Antonuk WB9RRT
P.O. Box 452
Marlborough NH 03455

I had completed construction of my new weather satellite receiver (see Hamtronics R139 review, *73*, November 1996), and had hooked it up to my discone antenna. I stumbled through the demodulator instructions, and had actually received and viewed lots of Automatic Picture Transmission (APT) pictures. Overall I was pleased with my success. As I began to decode more and more pictures, however, I found that I was becoming more and more critical of the results. The main problem was that the overhead passes were too short. Only rarely did I get a full screen image; in most cases I was recording a two- or three-inch picture with each pass. Even these images were broken up at the beginning and end of each display, and the pictures were cluttered with black and white spots and streaks. Something was obviously amiss, and I had a pretty good idea what it was.

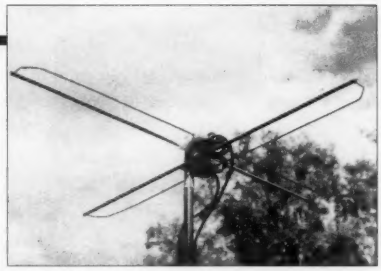
During my days as a Novice I heard an adage that has stayed with me: "A dollar put towards the antenna is worth twenty put towards the receiver." Adjusted for inflation this might come closer to two hundred dollars towards the receiver, but the message is clear. If you want good reception, you have to make sure that you capture the best signal available at your location.

Choosing an antenna system

When it came to antennas for overhead satellite reception I was somewhat in the dark. I quickly learned that there were two main paths to take. The first utilized a circular-polarized, fixed omnidirectional antenna with a fairly wide beamwidth, pointed straight up. This antenna made use of two crossed driven elements that sat above a pair of crossed reflectors, and was called a "turnstile" since it resembled, well, a turnstile. The second method also made use of a circular-polarized antenna, but a higher gain, smaller beamwidth yagi model. This was mounted on a dual rotator arrangement, to provide elevation and azimuth movement. It provided a much stronger received signal than the fixed option, but of course it needed to be continuously moved to follow the satellite as it traced its arc across the sky. There were even computer programs that would automatically turn the rotators, based on information about the satellite you fed in earlier.

I pondered my choices, and compared them to my current needs and resources. Obviously, the rotating method would provide the best coverage in borderline circumstances, and allow the most data to be squeezed from each pass. On the other hand, someone needed to make sure the rotators were turning the antenna correctly—it didn't sound like this was something that would occur automatically while I was at work, at least not without a whole lot of set-up work on my part. Besides, I really didn't care what the weather looked like when the satellite was down near the horizon—I wanted to see the picture mainly when the satellite was right overhead, which was when the turnstile antenna did its best work. The deciding factor had to do with simplicity and cost. I found that I could put up a turnstile antenna for about one-fifth the price of a yagi/rotor combination, and it looked like I could get it assembled and mounted right away.

Once I decided on the antenna I needed, the choice of manufacturer was obvious. I had come across a catalog from Woodhouse Communications, in Plainwell, Michigan. Woodhouse has a complete line of antennas, all designed for various types of APT reception. I sent a check off to Woodhouse, requesting their APT-2CP turnstile antenna.



I received the APT-2CP about a week later. As soon as I opened the box I was pleased with the purchase. The Woodhouse folks produce a special line of antennas, and they obviously take great pains to do it right. The vertical boom of the antenna is a piece of one-inch 6061-T6 aluminum tubing. Holes are drilled through the boom for the elements—no U-bolt arrangements here. The 18-8 stainless steel solid rod elements are pre-tapped for the stainless hardware that will hold them in place—no self-tapping screws or hose clamps. The baluns are true coaxial baluns, not ferrite bead types. The balun blocks are machined from HDPE plastic for UV stability and strength. Every part of the antenna, right down to the Ampenol connectors and Belden cable, is real quality stuff.

Setting up the APT-2CP

Assembling the antenna was fairly straightforward, and was done in under a couple of hours, including time for a break. The instructions give some hints on how to support the antenna with a couple

of sawhorses; this made construction quite easy. I had started the project in the early evening, and by the time I had the antenna ready to go up on the roof it was already dark. I decided to put the project off until the next day, but I did hook the APT-2CP to some coax which I tossed through the window into the shack. I didn't get around to mounting the tripod on the roof until a couple of days later, but in the meantime I found that my satellite passes were now at least twice as long—with the antenna still sitting on the ground!

I finally got the tripod mounted, and mounted the antenna on a piece of mast with the supplied stainless steel clamps. The only advice given concerning the location of the antenna had to do with maximizing the "horizon." In other words, get the antenna as high as possible, away from and above any obstructions such as trees and chimneys. (It is recommended that the turnstile not be side-mounted on your tower, and not below your beam!) Once it was on the roof I found that my passes improved even more, and I was able to get full screen images with little problem. In addition, since the antenna was fixed and omnidirectional I didn't need to mess with it at all—I just let my R139 receiver switch on the tape recorder when a satellite was going over, and collect the passes for me so I could demodulate them and review them at the end of the day.

As I collected more and more images, I found that I got even pickier and pickier. I began to notice that there were still a few patches of "snow" at the beginning and end of each pass. The point where the satellite signal was the weakest looked like it could still use some improvement.

"As I collected more and more images, I found myself getting pickier and pickier."

Improving the picture

I knew that receiver preamps were available, and that this might help improve my situation. I also knew that a preamp could actually degrade the system's performance—especially if there were a lot of strong signals around. I was somewhat near an airport, so I figured that I might be hit with aircraft transmissions, but I didn't have an excessive amount of public safety or commercial two-way traffic around the neighborhood.

My main concern was that I had been too cheap to go out and buy a quality piece of coax for the turnstile. I had used a 75-foot piece of RG-8 that I had previously used on HF, and I worried that there might be too much loss in it. I weighed the options, and figured that the preamp would be the way to go. Since I was using the Hamtronics R139 receiver, I ordered an LNG-137 preamp from Hamtronics.

The LNG-137 is similar to the LNG-144 preamp used in repeaters and for weak signal work, but tuned specifically for the 137 MHz weather satellite band. It comes preassembled, and requires a +12 VDC supply. (Hamtronics does sell a phantom power kit to allow you to run the 12 VDC up the coax, but I didn't want to mess with building up the isolators on each end. I simply ran a piece of insulated bell wire up to the antenna, and used the coax ground for -12 VDC.) I mounted the LNG-137 on a small (3" x 3") piece of aluminum stock, and mounted it to the mast below the turnstile. I made up a small jumper with the proper BNC connectors, and taped and caulked the unit with silicone sealant.

Testing with the preamp in-circuit showed improvement at the very beginning and end of each pass in the form of fewer of the black and white "dropouts." So far I haven't noticed any evidence of any of the problems associated with too much gain—intermod products, oscillation, etc. However, in my case, the use of the APT-2CP antenna (designed specifically for 137 MHz) as opposed to a broadband antenna will limit the strength of the out-of-band signals that are passed to the preamp. And the preamp, being tuned to 137 MHz, will favor those signals over out-of-band signals, as well. (If intermod signals do become a problem, I know I can add even more selectivity with a helical preselector, tuned to 137 MHz.)

The Hamtronics LNG-137 preamp and the Woodhouse Communications ATP-2CP turnstile antenna have proven to be a very straightforward, low cost approach to weather satellite imaging. The ATP-2CP is available from Hamtronics, Inc. (716-392-9420) or directly from Woodhouse Communications (616-226-8873). 73

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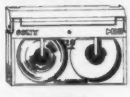

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73 Review

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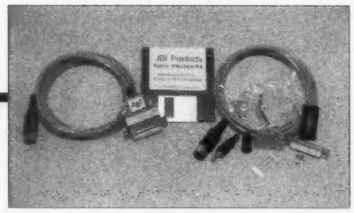

Shane P. Brady WB2WPM
34 Rosewood Drive
West Seneca NY 14224

You just can't beat having your radio talk with your computer for keeping your log straight and for contests, for passing on information such as time, frequency and mode, but obtaining a circuit board for such projects and even getting parts has been challenging. Lots of ideas have appeared in various publications for home-brewing your own interface, and of course you could purchase your radio's manufacturer's interface from them. Unfortunately, most OEM interfaces are in the $100+ category!

"Would I buy another one? Yes—that's exactly what I did."

For six years now, my station has had my Kenwood TS-450 (and before that the TS-440) interfaced with my computer logging program, Log-EQF. While at Dayton this year, I picked up a new IC-706. As I walked around with my new purchase, I was contemplating how to do the interfacing, knowing how lost I would be without a computer talking with my new radio. It just happened that I was at the Log-EQF booth when I noticed the interface they were using—a JBI Universal Radio Interface. Before leaving the booth I had the opportunity to meet John Bechtoldt, the owner/developer of the interface, who had stopped by to say hello. John told me that his interface worked FB with the new IC-706. When he told me the price, I was sold!

The JBI Universal Radio Interface Kit will interface virtually any modern radio (with computer interfacing capabilities) to a standard RS-232 port. This includes just about all the Kenwood, Icom, Yaesu, Ten-Tec, and even the Heathkit SB-1400 radios. While the interface is a stand-alone addition, a few radios do require some internal modification. This you must do yourself, and is not part of the kit. When ordering the kit specify which radio you have so the appropriate cable and plug will be included. The rest of the kit is universal.

About 10 days after ordering, a large brown padded envelope arrived. I was rather surprised at how few parts there actually were. Aside from some capacitors, resistors and diodes, there is only one IC to round out the electronics package. The remaining items are a PC board, DB25 female connector, multiconductor shielded cable and, depending upon which kit you ordered (Kenwood, Icom, Yaesu, Ten-Tec, Heathkit), the appropriate plug to match your radio—plus a very nice DB25 die-cast hood which eventually will hold all components!

Assembly

Assembly is smooth and quick, and could be a perfect first-time project. The instructions are straightforward, and include illustrations of how the finished PC board will look for each radio. The assembly instructions start off by having you insert the PC board in between the two rows of pins of the DB25 connector, and then soldering them in place (there are only seven pins which actually require soldering). As you are led step by step through assembly, you'll be told to skip certain instructions for certain radios, and to complete the steps for *your* particular radio. Depending upon which radio you are interfacing to, you may have an extra capacitor or resistor left over. Remember, this is a universal interface so you get all the electronic parts for *all* the various radios.

For installing components, the PC board has been properly lettered so you know which component goes where. The large illustrations provided take any guesswork out of where a capacitor or resistor belongs. The illustrations even show the position of the "banded" ends of the diodes, so you can't install them backwards.

The 16-pin IC is installed just about last; it's static sensitive—there's a warning to that effect in the instructions. Caution should be taken that you and your surroundings are all at the same electrical potential, so as not to destroy the chip with static. This installation does not use a socket, so you must solder all leads directly to the board. You shouldn't run into any trouble as long as you don't apply too much heat or make any solder bridges.

One final step: Before putting the assembly into the die-cast hood, attach the shielded cable to the PC board. This is the only place I had any reservations as to which wire went where. The instructions are written around a four-conductor shielded cable. The IC-706 only uses two conductors. A two-conductor cable was supplied with my kit, but wasn't mentioned in the instructions (I have since spoken with John Bechtoldt, and he informs me that this modification to the instructions has been addressed). With the cable wires soldered into the proper holes, it was time to button up the hood.

There *was* one personal modification. Experience has taught me to take the precaution of installing toroidal (ferrite)

cores on all radio and computer cabling in the shack, usually one core at each end of a cable. This step has eliminated the annoyance of inter-equipment interference, and I recommend it to everyone. After putting the halves of the hood together I put a couple of turns on a toroidal core, locating it up close to the hood, adding another core at the free end of the cable. The final step was to install the 1/8" miniature phone plug, which mates with the radio, on the free end of the cable.

Features

JBI also includes a 3-1/2" disk containing a number of DOS programs for rig control, so you will be able to test things right away. Having Log-EQF already on my computer, I used it as my test software. Anyone who has built anything knows the anxiety and dread just before adding power to a project to see if it actually works. I attached the interface to the computer and the radio, turned them on—and the logging program proudly announced it was talking to an IC-706 and showed the appropriate frequency and mode. A spin of the frequency dial and the computer followed along. Success! I was very pleased with the results: no interference, no hesitation—everything worked as expected.

One of the nice features of the JBI interface is that it requires no external power. Next to my Kenwood radio sits the Kenwood interface box, complete with its 12 VDC power plug that I've used for a number of years. Any time I can eliminate some congestion at the operating position I'm all for it, so it was only another week before off went another order to JBI—this time for a Kenwood interface kit. The second kit was identical to the first, with the exception of the six-pin DIN plug that matches Kenwood radios. Assembly was completed on this interface in less than half an hour. It too worked the first time and has performed flawlessly since. It is so convenient not to have that extra power lead running around the back of the station; the old Kenwood interface box, which required the external power supply, will be on my table at the next hamfest.

Currently, JBI Products and Technologies offers their Universal Radio Interface Kit three ways. The first is the interface kit, a genuine bargain, currently listed at $29.95. Manufacturers' interfaces run three to five times as much. Those who are leery of soldering a couple dozen connections may purchase the interface completely assembled, for a current list price of $45.00. The final option is an assembled interface but with the addition of a CW keyer option, at $59.00. The CW keyer option allows many logging and contest programs to key the radio via the computer keyboard. (Shipping and handling are not included in the above prices).

The instructions would be nicer if they were organized straight through for one radio, instead of skipping paragraphs for radios you aren't concerned with, and it would be nice to have included instructions for adding the CW option on your own—but if you want to add the option it really isn't that difficult. Most software programs such as CT and Log-EQF include the instructions for the small keying circuit, which only requires one transistor and one resistor. There is plenty of room in the DB25 hood for this CW mod. I recommend that you spend the extra five minutes on it.

I guess the final test as to would I recommend this kit would be, would I buy another one? Yes—that's exactly what I did.

For details and ordering information, contact: JBI Products and Technologies, 1418 South Yale Drive, O'Fallon IL 62269-2738. 73

NEVER SAY DIE

Continued from page 23

they say? Or are you going to fight back, educating yourself about your cancer and the alternatives open to you?

My advice, which I know most of you are going to ignore, is to do two things. First, do your best to make sure that you don't get cancer. I'm now convinced that cancer is 100% avoidable if you educate yourself by reading the books on health which are on my recommended book list (available from Radio Bookshop). Read, then make changes in your thoroughly ingrained habits which are slowly killing you. If you'd rather die than change, fine—you will. Second, if you don't change so you can avoid cancer, once it hits you can get my reading list and belatedly do your homework. Maybe by then you'll be ready to change your habits. Read the books by Drs. Comby, Wallach, Huggins, Batmanghelidj, Coca, Douglass, about Essiac, L214, and so on.

If you keep your immune system strong you aren't going to have cancer, heart trouble, and any of the chronic illnesses which beset about 99% of older people.

Continued on page 29

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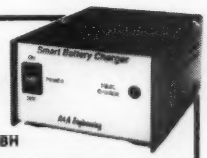

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Build This 6m Attic Antenna

A simple stealth antenna project.

Marty Gammel KAØNAN
1703 Hewitt Ave.
Saint Paul MN 55104

A local ham, knowing that I love to make different types of antennas, asked if I could make a shortened 6 meter vertical dipole for him to use in his condominium. Due to his covenant restrictions, his ham antennas have to be indoors and out of sight. I had been doing some reading on helically-wound antennas and told him to give me a week to get the bugs out of the design. With just over eight feet of height to work with in his crawl space, we didn't have to shorten the antenna very much. I came up with a seven-inch spacing between turns so that the antenna would not have a lot of inductance.

The problem with making a helically-wound antenna is that to figure the length of the dipole you must add about 5% to make up for the inductance created by the coil. Also, you'll have less bandwidth with a more compressed coil winding. *The ARRL Antenna Book* states that there are no exact, predictable results when winding shortened antennas. Wire diameter, coil diameter, and compression of the coils all interact with each other.

This antenna covers the 52 to 54 MHz portion of the 6 meter band. It has an SWR of 1.3 or less, with a smooth SWR curve.

My design is built using a piece of fir closet rod from the local building supply, and some #6 solid copper wire of the type used in wiring houses. The only other parts were an SO-239 panel-mount fitting for the feed point and a couple of screws to attach the SO-239 to the closet rod. I knew that a quarter-wave section of RG-59 coax for a balun would also be needed, to match the 72-ohm dipole to 50-ohm coax.

"With just over eight feet of height to work with in his crawl space, we didn't have to shorten the antenna very much."

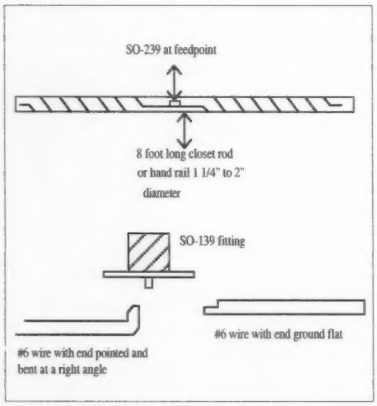
SO-239 at feedpoint
8 foot long closet rod
or hand rail 1 1/4" to 2"
diameter
SO-139 fitting
#6 wire with end ground flat
#6 wire with end pointed and
bent at a right angle

Fig. 1. *Shortened helically-wound vertical dipole for indoor installations in your attic or crawl space. (Drawing not to scale.)*

OK, let's build it!

I started building this antenna by cutting the #6 solid copper wire into two equal pieces slightly longer than needed, to allow for fine-tuning the antenna. This antenna was planned for use in the FM section of the 6m band, so a 57-inch length was good to start with. Using my bench grinder, I ground one end of one piece of the copper wire to a taper to fit the center terminal of the SO-239 fitting. Then I ground one end of the other piece of copper wire flat to create an end that would be more easily attached to the flat surface of the body of the SO-239 fitting. I enlarged two of the SO-239's four mounting holes to ease attaching this fitting to the center of the closet pole. Bend the tapered end of the wire at a right angle to make a neat connection to the SO-239 fitting. Get out your soldering gun and flux to attach the ends of the wire to the SO-239 fitting. This will require a *lot* of heat; my gun is a 350 watt model and was just big enough. Once you have attached both of the wires soldered to the SO-239 fitting, allow it to cool completely before cleaning the excess flux off the surfaces.

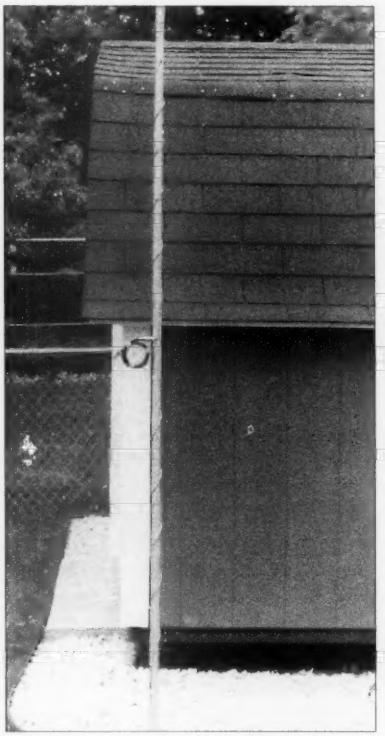

Photo A. *The completed 6m attic antenna.*

Winding the antenna

Now comes the tricky part. I had my wife hold one end of the closet rod and wire while one of my sons held the other end, leaving me with both hands free to wind the wire tightly on the closet rod, using the width of my hand as a guide. I taped this end down before winding the other half. When I was satisfied that the two sides looked equal, I taped this side to the rod, leaving at least six inches straight on each end for tuning the antenna.

Next, make a quarter-wave line section of RG-59 coax to change the 72 ohm impedance to a more usable 50 ohm impedance. Most RG-59 coax has a velocity factor of .66 or .79. The formula found in most ham radio books is 249 divided by the frequency in MHz times 12 for a quarter-wave length in inches. RG-59-A foam coax with a .79 velocity factor is what I had on hand, so my line section was just over 45 inches long. I stripped the ends and installed a PL-259 fitting on each end of the coax with UG-176 type reducers. I wound the quarter-wave line section into a coil, taped it together (see **Photo B**), and installed it at the center of the antenna.

Tuning the antenna

I tested the antenna under conditions similar to those where it would be used, taking care to keep it away from metal objects and other dense masses which might detune it. Using an SWR bridge capable of working at 50 to 54 MHz, I took readings at each end of the desired frequency of operation. Using diagonal cutters, I trimmed the same amount off each end of the antenna, rechecking the SWR after each cut until I had a good match. I ended up with 55.5 inches on each side of the shortened dipole. The match on my antenna was 1.25 at 52 MHz and 1.1 at 54 MHz, with a dip to 1.05 at 53.5 to 53.75 MHz. I used a file to smooth the dipole ends to prevent a corona effect.

Builder's notes

You may want to paint or varnish the wooden rod before construction to help seal the surface against humidity and to keep it from warping. If you can't find #6 bare copper wire you may use #8 wire instead, or copper tubing of about the same diameter. Try to leave at least six inches clearance at each end of the dipole to avoid detuning the antenna. The reason I didn't use a torch to attach the #6 solid copper wire to the SO-239 fitting was that the heat of the torch would damage the insulating section of the fitting.

Readers who have questions about this antenna may write to me at the address above, including a #10 SASE, and I will answer by return mail. 73

Parts and Tools

- 8-foot fir closet rod 1-1/4 inches in diameter (this can also be a larger size of handrail)
- 114 inches of #6 solid copper wire
- SO-239 panel mount fitting
- 2 PL-259 fittings, with UG-176 type reducers for the balun
- RG-59 coax, 40 to 48 inches long, depending on the coax velocity factor (see text)
- Large diagonal cutters or a hacksaw (to cut the wire)
- Solder and flux
- Good hefty soldering iron or propane torch
- Screwdriver
- Electrical tape
- Grinding wheel (or use a file)

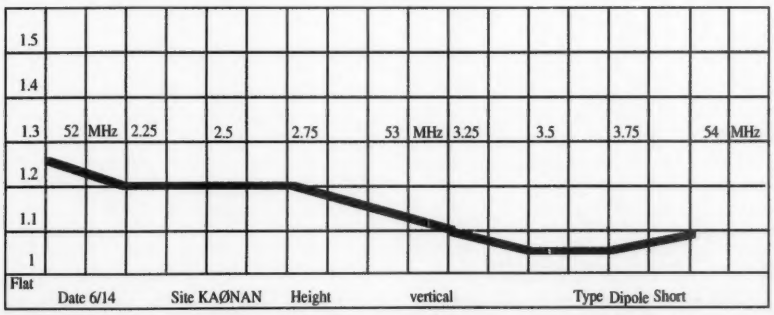

Fig. 2. SWR curve. Please use an SWR meter designed for use with accuracy at these frequencies.

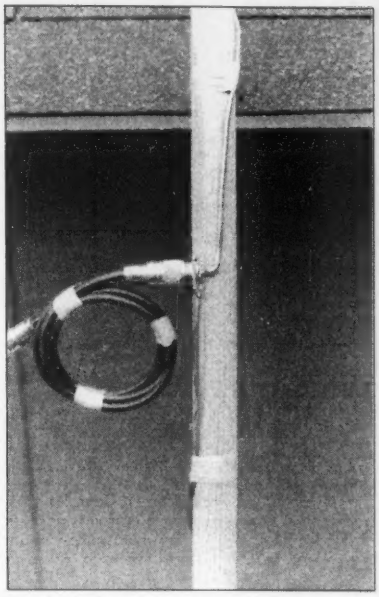

Photo B. Close-up.

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NEVER SAY DIE

Continued from page 27

Oh, I give up. I've been telling you this over and over for months and I'm just not getting through. Go ahead and end up in a nursing home in your 70s. Or buried.

I know, you want me to write about working DX, contests, antennas, and stuff like that and you wish I'd stop pestering you about our so-called health care system. You enjoy smoking and don't believe that you are going to be one of the 400,000 a year who die as a result. You enjoy beer and Big Macs and never mind that big constipated gut hanging over your belt. You enjoy these things more than life itself.

Hey, please write and tell me to stop being a scold about this and to get back on the air and swap signal reports with a few hundred retired old men.

QSLs

How original and creative is your QSL? How much time and effort have you put into having it represent *you* and your interests? But even a plain vanilla QSL beats the heck out of none. In looking through my cartons of QSLs the other day, they brought back

Continued on page 38

Circulators, Anyone?

Keep the traffic flowing.

Byron Mobus W6OIU
3099 Twin Oaks Rd.
Cameron Park CA 95682-8517

I answer my phone and the manager of the site where our repeater is located tells me that the site is being rearranged. All of the amateur repeaters are to be relocated into one building—the one where our repeater has been located since 1947. Under the new arrangement, the six amateur groups will be responsible for the upkeep and operation of the building, including sharing the costs and electricity. We've had a free ride for many years, but financial realities are about to catch up with us.

Our repeater, W6AEX on 147.27 MHz, is owned and operated by the Society of Amateur Radio Operators (SARO), and the late owner of the mountaintop, Tom Bayley W6NQJ, was a longtime member. Tom made provisions giving us use of the site for as long as the club wanted to have a repeater. We were located in the smallest building on the site, with two commercial operations; one on low band and the other in the microwaves. There was no apparent problem with interaction between the equipment in the building, so we operated with a duplexer and a single antenna on the tower.

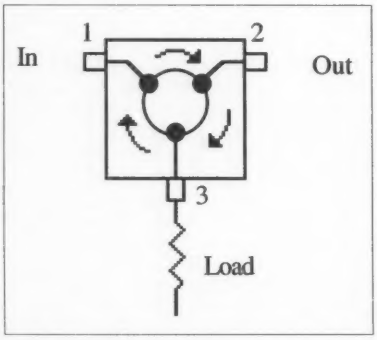

Fig. 1. Single-stage isolator.

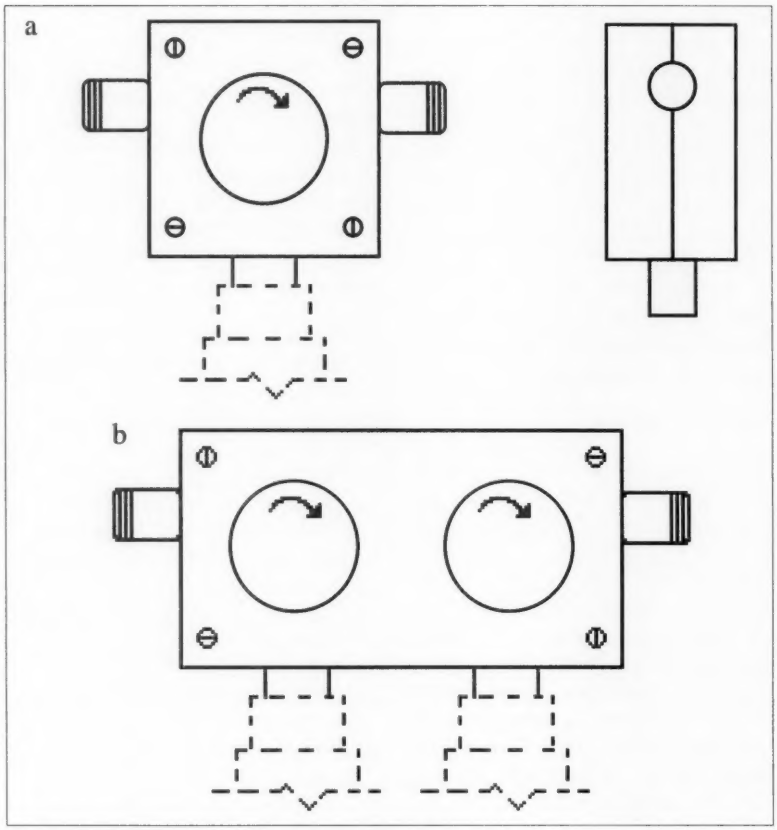

Fig. 2. a) Single-stage isolator; b) Dual-stage isolator.

Under the new regime, there would be several repeaters in the 2 meter and 70 cm bands all operating together in the same building and on the same tower. In an effort to streamline the operation, several big changes were to be made to the equipment to minimize interaction and to keep the noise floor as low as possible. There would be common receive antennas with distribution and amplification to the appropriate receivers. Each transmitter would have its own antenna. One major change was the addition of circulators to the output of every transmitter.

What are circulators?

Circulators? What are they? As a former communications technician for a major oil company, I have maintained microwave equipment that used

circulators, but they never broke so I never paid much attention to them (my philosophy is: "If it ain't broke, don't fix it!"). I started looking around for information on circulators and found less information available on them than on duplexers, which means it's pretty scarce. A friend had a 250 watt circulator for the 150 MHz band which he made available, so I set out to learn what I could about their operation.

A circulator is a device with three or more ports in which RF energy is conducted in one direction with little loss, but exhibits a high attenuation in the opposite direction (**Fig. 1**). There are single-stage and double-stage circulators (**Fig. 2**), your choice depending upon the amount of isolation and insertion loss you require. This is done by arranging ferrite material to provide a high magnetic field through the RF conductor.

RF energy introduced into port 1 is transferred to the antenna at port 2 with more than 30 dB loss to port 3, which is terminated with a dummy load. With 100 watts at port 1, almost all of the power is available at port 2 and less than 0.1 watt goes to the dummy load. Any power returned from the antenna by either an unbalance or the presence of a close-by high power transmitting system is circulated to port 3 and the dummy load. The presence on or near the site of a commercial FM transmitter with an effective radiated power of 250 kW to 500 kW can present an appreciable amount of power to the output of a communications transmitter.

A circulator is a little like a traffic circle with several streets coming into it. As you (transmitter output) enter the traffic circle (input port) en route out of town, the traffic is circling in one direction. You circle in this direction until you reach the next street (output port), then you exit. Traffic (reflected power, received signals, etc.) entering the traffic circle from the street you exit on moves in the same circle direction to the next street where it exits and enters a parking lot (dummy load). This traffic could be from out of town (received signals), or even returning traffic (reflected power) turned around by a problem down the street such as a bridge out (broken coax) or a tree down (shorted antenna). The orderly flow of traffic is ensured by the police (magnetic field) enforcing the law.

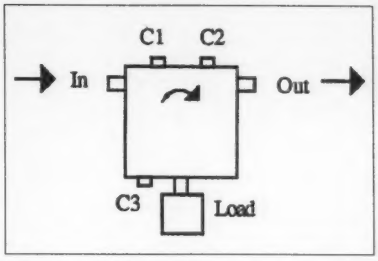

Fig. 3. Field-tunable circulators usually have three tuning adjustments.

Tuning

Field-tunable circulators usually have three tuning adjustments (**Fig. 3**) and the unit is tuned by using a very accurate signal generator and spectrum analyzer or a network analyzer (**Fig. 4a** and **4b**). A 6-10 dB pad is added to the test setup to minimize VSWR reflections in the test equipment. The signal is sent into port 2 (output) and measured at port 1 (input) with a dummy load on port 3. C3 is adjusted for a minimum transfer. The generator is then hooked to port 3, measured at port 2 with the dummy load on port 1. C1 is adjusted for minimum. The generator is then hooked to port 1, measured at port 3 and the dummy load on port 2. C2 is adjusted for minimum. Finally, the generator is hooked to port 1, measured at port 2 with the dummy load on port 3, and the insertion loss is measured.

The circulator I had was tuned to around 160 MHz with no provision for tuning, so I took the covers off. There were pieces of iron attached around the outside of the magnets and when they were removed, the tuning frequency dropped to the 140 MHz range. By careful addition of pieces of iron around the outside of the magnets, the unit was tuned to 147.27 MHz. Unfortunately, when the forward loss was measured, it was around 3 dB, which probably explains why the unit was discarded in the first place.

The unit was further dismantled and I found a triangular brass plate mounted between two big magnets with a connector attached to each apex of the triangle. This was sandwiched between large magnets with heavy iron covers. The ferrite material was badly broken, probably from being dropped, possibly accounting for the poor performance. An identical circulator was located and the tuning procedure was used to put it on our frequency. This time the insertion loss was only 0.2 dB.

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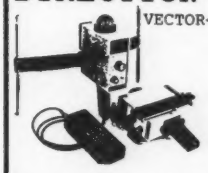

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CIRCLE 58 ON READER SERVICE CARD

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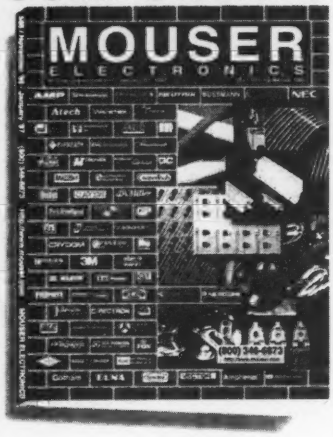

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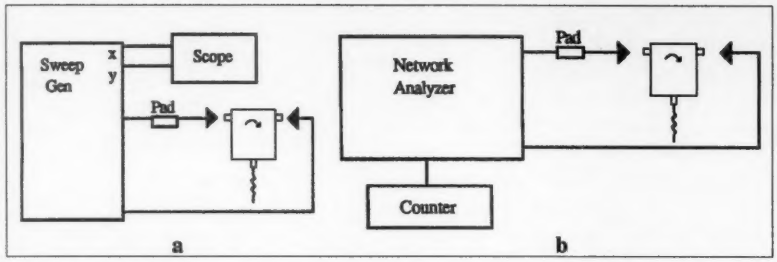

Fig. 4. The unit is tuned by using a very accurate signal generator and spectrum analyzer (a), or a network analyzer (b).

It was installed, along with a cavity, on our repeater. Ferrite isolators are subject to certain nonlinearities and may conduct or generate weak signal harmonics. To protect against second and third order intermodulation harmonics, a low-pass second harmonic filter or cavity is used between the isolator and the antenna. At microwave frequencies, circulators are used instead of duplexers. A circulator might be used at lower frequencies if the isolation is adequate, depending on the transmit and receive frequency separation, but the cost difference between a duplexer and circulator would then become a factor.

In the meantime, an isolator was ordered tuned to our frequency and power, and when it was received it was substituted for the borrowed unit. With other improvements—better grounding, tower bonding, rack bracing and painting—the site looks better and the repeater appears to be working better. At least, there has been no apparent degrading of the repeater from the addition of all of the other equipment in the building. 73

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CIRCLE 69 ON READER SERVICE CARD

Hams on the Radio Information Highway, Part 2

How you can easily find and start using Usenet newsgroups.

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Carson City NV 89703
jheller@sierra.net
CompuServe 72130,1352

Last month I told you about my discoveries on the World Wide Web (WWW) portion of the Internet and about getting hooked up to do the same yourself. I think the number one reason the WWW so intrigues people is that once you get the hang of it, it's easy to move from site to site and find treasures in ham-related up-to-date information. This month, we are going to check out one more part of the Internet where hams have set up house, and I'll to show you how easily you can do it.

Let's explore the Usenet newsgroups. You are not alone if you have heard the name "Newsgroups" but aren't sure exactly what they are. The easiest way to get the picture is to compare it to a forum on CompuServe, America OnLine or one of the other major on-line services: People with similar interests gather and answer each others' questions, or just chat.

One way to imagine what the newsgroup world is like would be to assume that your town has five groups of people, each group with a different interest; also let's say your town has five repeaters and all these groups consist of hams.

It would be pretty simple to assign each group a repeater and a time to get together. This could work. I have never heard of it, but even if it were put into practice, it wouldn't compare to the possibilities of the computer bulletin board or Internet.

Where we spoke of five special interest groups getting together, that was OK, but what happens when there are several hundred—or several thousand? The "thousands" number is the extent covered by the Internet newsgroups, and they reach worldwide. Although only a small part of that is devoted directly to ham radio, many other areas hold related interests for everyone.

Let's look at what is found in the ham radio newsgroups and the basics of getting in on the action. When you get this under your belt, perhaps you'll feel quite comfortable exploring the rest of the Internet. To give you an idea about which newsgroups are ham related, here are a few of the newsgroup names (think of them as addresses):

rec.radio.amateur.antenna
rec.radio.amateur.equipment
rec.radio.amateur.space
rec.radio.amateur.misc
rec.radio.amateur.digital.misc
rec.radio.amateur.homebrew
rec.radio.amateur.policy

The names of these newsgroups are chosen carefully so they will be intuitive to you. You probably can understand what most of the above means with no explanation. The "rec." simply stands for recreation.

There are several other basic groups. For instance "comp" stands for computer and "sci." refers to science. Within the ham newsgroups, anything with a "misc." is obviously a catchall and "policy" covers subjects like no-code and other perennial topics.

Now the question is, "How do I get these newsgroups with the software we described last month?" I must admit I was a little intimidated when I decided to write this using a brand-new version of a program that is still in its test and development stages. The company (Netscape) has experienced some hitches during the development, but I think this version (2.01) does the trick.

I have heard complaints about 2.0, yet I used 1.2 prior to this for most of a year and it was excellent. As of this writing, there are already upgrades available for download. It is at least as difficult to keep abreast of the changes on the Internet and its component software as it is to attempt to explain how to program a new HT. (I keep my manuals handy for programming those "intuitive" little machines.)

Netscape 2.01 comes with a raft of bells and whistles that I was sure would be difficult to understand, but the folks at Netscape did something I really like that takes the edge off the learning curve. They do not at this time have a help file built into the program, but if you go to the "Handbook" button and

click on it, you will be connected directly to the Netscape homepage.

There you will be introduced to a voluminous manual that you can scan through and/or download and print for yourself. It comes in sections, so I printed the part needed for using newsgroups and E-mail. This current documentation is an improvement over past instructions furnished by the company. One thing Netscape makes possible is the "Save as" feature. You can select "Save as" from the file menu and specify the directory in which you want to store the Handbook, or any web page, and you will have it to read or print offline. You can open your saved file into Netscape as long as it can find "windsock.dll" or you can import it into a word processor.

New adventures

Last month, I mentioned that the *Yahoo!* search engine will also explore the newsgroups to aid you to find those to fit your interests. I suggest that if you wish to do this and you have found your way to the Netscape search engine page by clicking the "Search" button, you just need to go a few steps further.

If you will scroll down Netscape's search engine page below the prominent choices of five search engines, you will discover lines you can click to go directly to such sites as *Yahoo!*

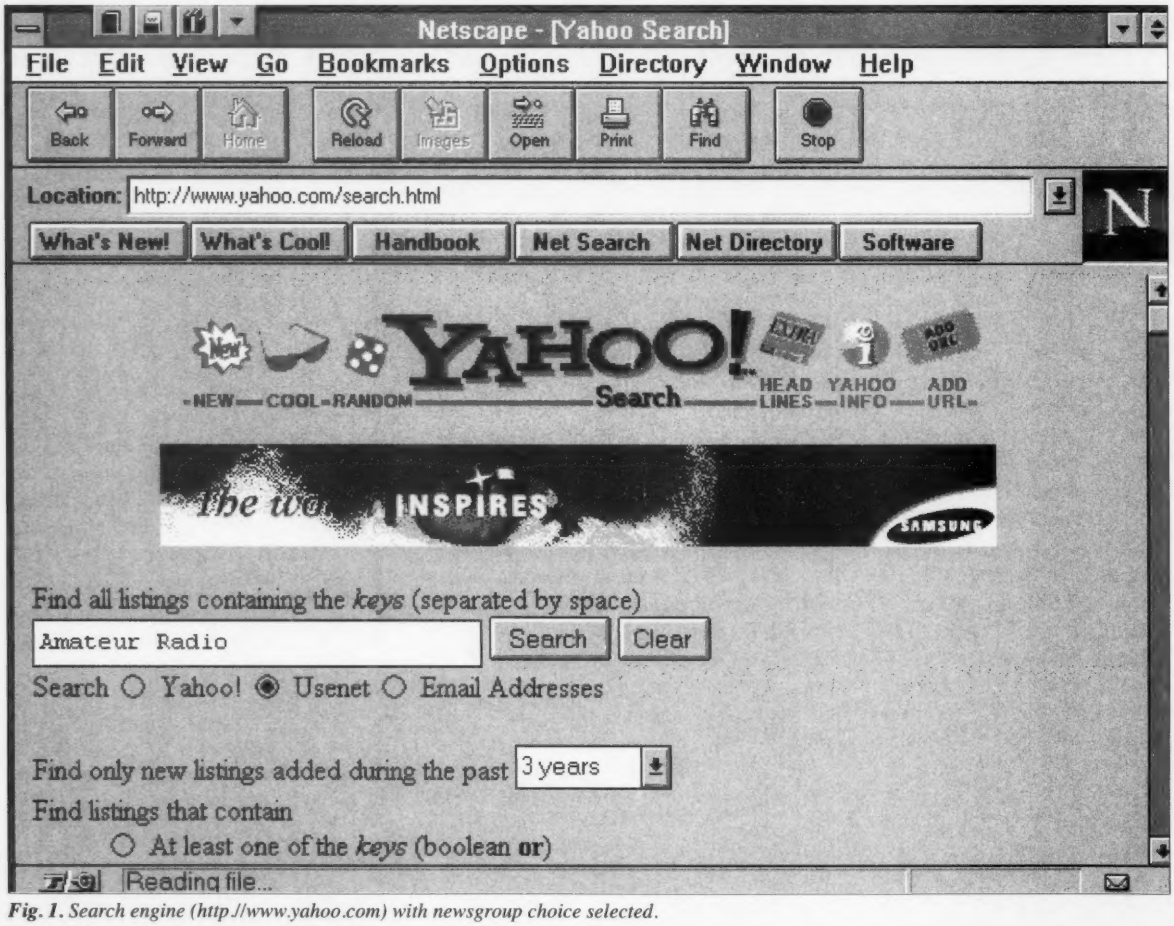
Click on *Yahoo!* and it will look similar to **Fig. 1**. You will notice that to the right of the box where you would type in "amateur radio" there is a line that reads "options." When you click there, a list will appear that includes "newsgroups." Select that and your search will give the results of a newsgroup search. You have conquered another area of the Internet.

Here are a few pointers to help you get started on the road to success. First, you need to know there are three basic screens you are going to use as you communicate on the Internet: The Web Browser screen, the Mail screen and the News screen (for newsgroups).

The Web Browser can be found in the File menu and the other two are available in the Window menu. Also in the Window menu are two other screens; one for Bookmarks (so you can easily return to an informative website at a later date), and another to display E-mail addresses you consider worth keeping.

The newsgroup screen will look like **Fig. 2** when you open it. You will need to have your connection made to your server. Click on the newsgroup in the upper left panel and hit an "Enter" to get the program to access the net and retrieve the news messages for the newsgroups you "subscribe" to. The panel borders allow you to adjust them to your preferences by clicking on them with your mouse.

As you discover more newsgroups that interest you, you will want to add them to the list. You will find "Add newsgroup" in the file menu, and upon selecting it, you'll have a pop-up screen. Enter one of the newsgroups "addresses" (example: "rec.radio.amateur.equipment").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Back Forward Home Reload Images Open Print Find Stop
Location: http://www.yahoo.com/search.html
What's New! What's Cool! Handbook Net Search Net Directory Software
YAHOO!
NEW COOL RANDOM Search HEAD LINES YAHOO INFO ADD URL
INSPIRES
SAMSUNG
Find all listings containing the keys (separated by space)
Amateur Radio
Search Clear
Search Yahoo! Usenet Email Addresses
Find only new listings added during the past 3 years
Find listings that contain
At least one of the keys (boolean or)
Reading file...

Fig. 1. Search engine (http://www.yahoo.com) with newsgroup choice selected.

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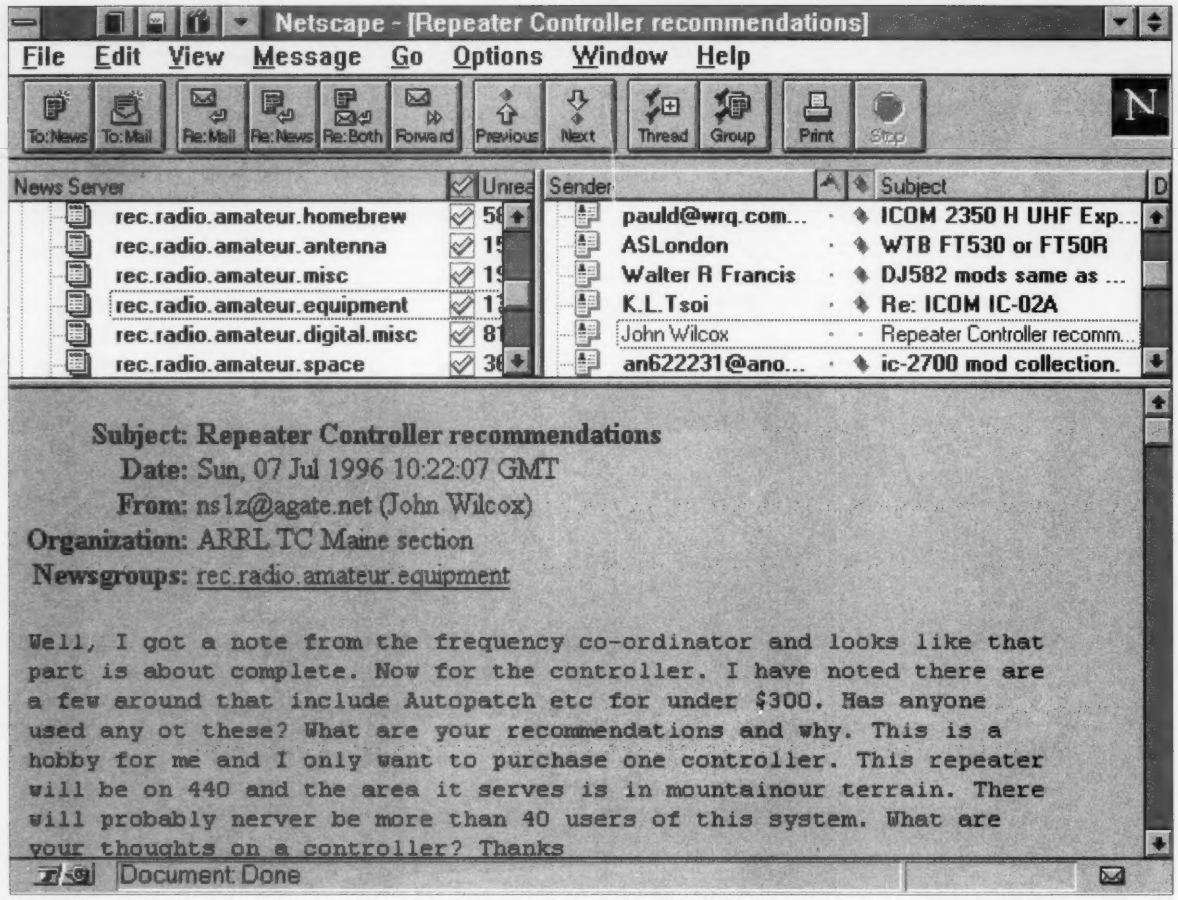
Netscape - [Repeater Controller recommendations]
File Edit View Message Go Options Window Help
To:News To:Mail Re:Mail Re:News Re:Both Forward Previous Next Thread Group Print Stop
News Server
rec.radio.amateur.homebrew
rec.radio.amateur.antenna
rec.radio.amateur.misc
rec.radio.amateur.equipment
rec.radio.amateur.digital.misc
rec.radio.amateur.space
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Subject
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ICOM 2350 H UHF Exp...
ASLondon
WTB FT530 or FT50R
Walter R Francis
DJ582 mods same as ...
K.L.Tsoi
Re: ICOM IC-02A
John Wilcox
Repeater Controller recomm...
an622231@ano...
ic-2700 mod collection.
Subject: Repeater Controller recommendations
Date: Sun, 07 Jul 1996 10:22:07 GMT
From: ns1z@agate.net (John Wilcox)
Organization: ARRL TC Maine section
Newsgroups: rec.radio.amateur.equipment
Well, I got a note from the frequency co-ordinator and looks like that part is about complete. Now for the controller. I have noted there are a few around that include Autopatch etc for under $300. Has anyone used any ot these? What are your recommendations and why. This is a hobby for me and I only want to purchase one controller. This repeater will be on 440 and the area it serves is in mountainour terrain. There will probably nerver be more than 40 users of this system. What are your thoughts on a controller? Thanks
Document Done

Fig. 2. The upper left panel shows the newsgroups and the number of messages. Upper right are the headers of the articles in the selected newsgroup. Lower panel is the selected message. You can change the panel borders to suit yourself.

Press "Enter" and the program will access the net and retrieve messages. Click on the line you just created in the upper left panel and you will see a list of headers in the right panel. Pick one, click on it, and the message will show in the lower panel. You are on your way! (I noticed a disconcerting thing happening the first few times I did this. When I shut down the program and came back, my freshly installed newsgroup would vanish. After careful study of the Handbook, I found I needed to click *on the check marks* in the upper left panel as seen in **Fig. 2**.) You will also want to study the various choices in the Options menu. They affect what is displayed in the upper left panel.

Now on to the fun stuff. The spirit of ham radio is alive and well on the Internet. One of the great advantages is having a place to go where your area of interest in the hobby can be addressed, and there are numerous hams who come back, sometimes within a few hours, with helpful hints.

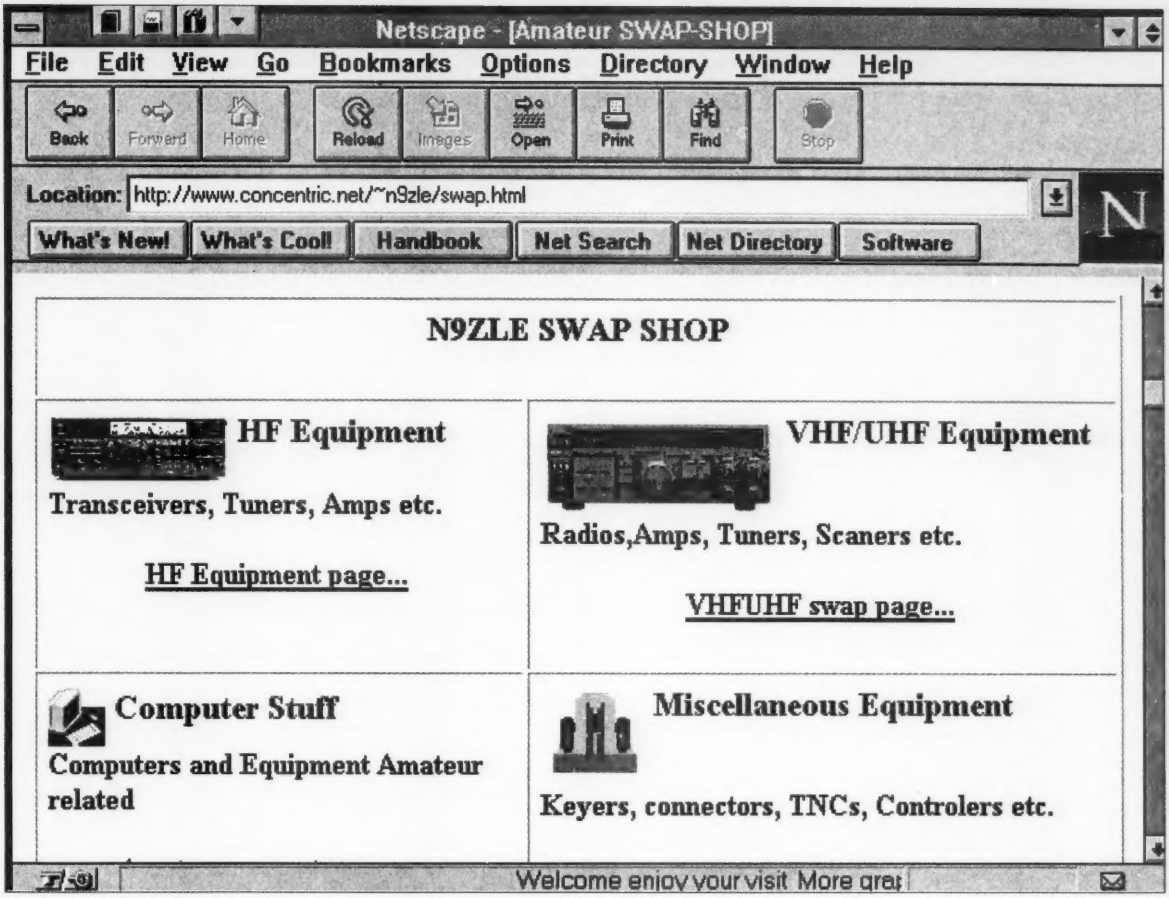
You will find messages posted about subjects all the way from old-time radio to high-speed modems and spread spectrum. I even ran across a few queries that I posted a suggestion for. One thing is obvious—the amount of ham activity is such that the message board spans a period of just a few days, about a week. This means the same messages don't appear time and again, and if you need to communicate, you must not hesitate.

As you read the messages posted in the newsgroups, you find many references and often clickable links to web or FTP sites for current information that you may not have come across any other way. One example was a message that contained an easy link to a website containing information about digital mode software. There are numerous such opportunities; you just have to look to appreciate what is available.

Another familiar aspect of ham radio is obvious on the net—courtesy. Every message I've read is positive. No one is derided for asking a "stupid" question. Even when someone of a lower intelligence group posted an offensive profane message, it was handled with utmost politeness and refusal to sink to the level of profanity that had been posted, typical of the ham community.

Yes indeedy—vulgar language does exist on the Internet. What you might see in the ham sections will likely be posted by a non-ham who desires to cause an uproar. The practice doesn't seem to be prevalent, but I don't think there is a way to control childish pranks. Perhaps the Internet sages will come up with a method that would be less disastrous than a government attempt at regulation.

On an upbeat note, you may have enjoyed the experience of having someone give advice over the air that results in an instant fix of an equipment problem. The chances of this happening over the air are slim, due to limited exposure to those who may be able to copy us or have any interest in "reading our mail."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Welcome enjoy your visit More grea

Fig. 3. One of the various swap areas on the net, referenced from a newsgroup posting.

Chances improve exponentially when you talk to a captive audience such as in a newsgroup.

The Internet is one more place where you will find and can join with hams buying and selling equipment (**Fig. 3**). There are several swap areas you will run across (they become obvious) and there is always the chance of striking a good deal. There are many hams looking for equipment that might just be sitting around in your shack.

If the idea of this massive media intimidates you, you are not alone. The number of new folks signing on every day must be astronomical. Quite a few of them, outside the ham areas, are leaving messages begging for E-mail just to see "if it really works." It's reminiscent of the first time on the air for many of us.

Folks who feel insecure with a new medium are justified in their fears, I feel, when they have jumped into an E-mail or newsgroup arena where they feel no common bond. When you, as a member of the vast ham radio fraternity, log onto a ham newsgroup, you are right at home among friends. 73

73 is accepting manuscripts for the June 1997 Field Day Issue.

If you had a good time at that last Field Day, or have ideas about how to make Field Day a big success, submit your manuscript on a 3 1/2 inch disk, along with a print out and photos, by the end of February, to Joyce Sawtelle, 73 Amateur Radio Today, 70 Route 202 North, Peterborough NH 03458.

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NEVER SAY DIE

Continued from page 29

vivid memories of the people behind the cards, many of whom I got to know personally.

Take for instance the KV4AA card. Tens of thousands of hams will never forget Dick Spenceley's machine-like fist from St. Thomas. This card confirmed a contact with me when I was operating from Curacao, where I was visiting PJ3CC, who ran a vacation hotel which included scuba diving and a ham station, sitting atop a cliff overlooking the Caribbean. How could I not go there?

I first got to know Dick when I inherited him as my DX editor when I took over as editor of *CQ* in 1955. It didn't take long for me to find an excuse to fly down and visit Dick and his wife Anna, and to work a little DX with his Johnson KW rig. I also got in some great diving and found a horse to rent so I could ride around the beautiful Magan's Bay area. I rented my diving equipment from Leslie Caron's father, who ran a dive shop there.

One of Dick's friends, another KV4, had a little plane, so I was able to take some marvelous pictures of the island. Then there was the six-pound lobster I speared which provided dinner for the whole Spenceley family.

Well, you're tired of my ham memories, so how about you? Dig into your old QSLs and tell us some stories that they bring back for you. Don't forget to send me a disk copy. No, I won't lose your QSL.

Like the time I visited VK6RU in Perth in 1966 and he whipped out my QSL from 1946. That was during my ham African safari trip, where I continued on around the world after shooting anything that moved in Kenya and visiting Robbie 5Z4ERR in Nairobi. I hope you can get even a fraction as much adventure from hamming as I have. Hey, it's there, waiting for you, but you have to make the first move. The brass ring is out there, but you have to lean way out to grab it. If your QSL file doesn't bring back memories of ham adventures, maybe it's time to kick yourself in the butt. And don't give me any of that "Gee, I can't afford something like that" baloney. Money is easy to make once you know the secret and are able to try a new paradigm. Or is one digm enough for you?

I can point the way, but I can't force you to make changes in your life. Yep, change sure is difficult to make. But the world is constantly changing, whether you do or not, and it's going to leave you behind, fussing about things, but never really doing anything about them. Ooops, there I go preaching again. Sorry about that. The hams with rusted-in attitudes say, "There goes Wayne, bragging again," when I tell about my adventures. The few hams who are still not brain dead say, "Hey, Wayne's right, I *could* do that!"

My $5 book, *Making Money, a Beginner's Guide*, explains the secret. I should charge $5,000 since I know gratitude is one of the least felt of all emotions. The demand for the book has been brisk, as a result of my May appearance on the Art Bell W6OOB radio show, and then its repeat broadcast in August. The nice part for me is that I'm already getting letters thanking me, saying wow, it sure works!

I don't care how old you are, if you make some changes in your life you can get on the air from Fiji and Tahiti too. And Nepal. Or even from a king's palace. Or you can work the world from a farm in New Hampshire, where the air is pure and the living about the best in the whole country. Or both. Heck, why not? Or, let's see, what's on TV tonight. Or is it time to call into that old 75m net? Your choice—adventure or status quo.

Enlightening

How many seconds a day on the average do you get out of your ham shack long enough to look up at the sky, close enough to the sun so some of those UVs get into your eyeballs? And without any glasses or windows to filter 'em out?

Now, second question. How many hours a day do you think the people you're descended from spent a day getting UVs into their eyeballs? Before eyeglasses and windows were invented?

Third question. Would it surprise you to learn that getting those UVs into the eyes is vitally important for your health? That a million or so years of living with UVs has developed a dependency on it for your body?

If I can get you to spring the five bucks for my book list, and then go absolutely hog wild to buy a few books and read 'em, you'll learn a whole lot about what your body needs in the way of food, minerals, water, UVs, oxygen, and so on. Needs, and isn't, for the most part, getting.

I've put in a heck of a lot of work finding some books which are exciting and valuable. What I haven't figured out yet is how to get you to read 'em and start changing your life. Sigh.

So now, in order to ignore the above light news so as not to have to change your way of living (and being sick), you're saying to yourself that there goes Wayne exaggerating again. I know you haven't read the Ott or Lieberman books on my recommended list or you'd have written to thank me. Well, maybe I can get you to check out *Sunlight* by Dr. Zane Kime, ISBN 0-9604266-2-5, $12, 315p, World Health, Box 408, Penryn CA 95663. How does sunlight affect cholesterol, blood pressure, and the immune system? No, I'm not selling the book.

Okay, if you don't care enough about your own health to read it, will you educate yourself a little to help your kids live healthier lives?

Autism, Etc.

The *60 Minutes* segment on autism was interesting. You remember *Rainman*. Did you know that before vaccinations autism was almost unknown? As were hyperactivity, dyslexia, and learning disabilities in children?

Did you know that in a double-blind test the polio vaccine caused twice as many cases of polio as it prevented? According to the CDC, 87% of all polio cases between 1973 and 1983 were caused by the vaccine.

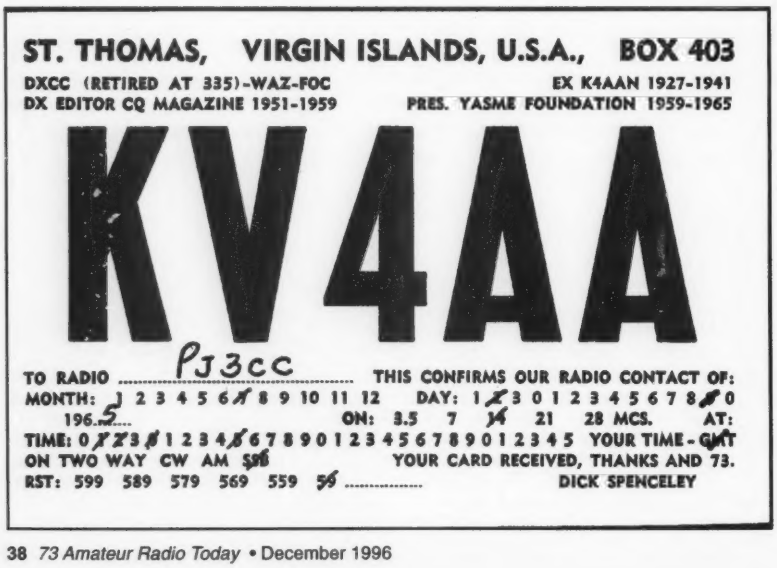
And, oh yes, talking about compulsory poisons, did you know that tests with animals show that they are made much more docile when given fluorides? Like those being added to your water and you're drinking unless you're distilling out the fluorides, chlorine, and other mischief.

Between these compulsory poisons helping to fry our brains, the flowering drug culture and our worst-in-the-developed-world schools, kids' SATs are way down, so they're lowering the scale so it won't look as bad.

If you'll read a couple of the books I recommend you'll learn that sugar and white flour are almost as destructive to your body as they are for your car if you put them in the gas tank. No wonder our police are causing so many problems on their Dunkin Donuts diet.

The Junior Researcher Alchemy Kit

Will it be an entrepreneur or one of the big toy companies that comes out with the first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cold fusion alchemy kit for our budding scientists? (And makes bazillions?)

I was seven when I got a Chem-Craft chemistry set for Christmas. It was beaut! The experiment I remember best was the one using potassium permanganate plus a couple drops of glycerin and then, in about half a minute, the mixture would start bubbling and burst into flame. Wow!

The cold fusion field has developed enough now for a kit to be marketed which would enable experimenters to measure the excess heat generated using different metals and electrolytes. Complete with an interface so a computer could record the data and chart it.

You'd need a small glass cell and a surrounding calorimeter. Hey, if they can sell indoor-outdoor thermometers retail for under $15, that's about all you'd need to measure the inside and outside calorimeter temperatures. I'd supply some powdered metals such as palladium, nickel, and titanium, and the chemicals to make various electrolytes. A wall-wart power supply could supply the current to trigger the reaction. Plus a small motor to stir the electrolyte to distribute the heat evenly. I'll bet the whole kit could be marketed for under $200.

If it were my company I'd be selling refills, plus other kinds of powdered metals such as rubidium, rhodium, and anything else that has a suitable lattice structure for generating excess heat. I'd also start a newsletter for junior researchers, plus include instructions on how to patent your discoveries. This is pioneering territory and the fact is that kids could come up with better and better cold fusion systems.

I'd also look around for a college with one of these newfangled instant mass spectrometers where experimenters could, for a small fee, send samples from their used cells to find out what transmutation products have been generated in the process.

In a recent test using nickel with a lithium sulfate electrolyte in plain water, a cell generated generous amounts of iron, gold, copper, magnesium and chromium ... and, oh yes, heat.

Well, you're probably too busy to be interested in making bazillions anyway, right?

Donor

Perhaps I'm on more mailing lists than you, but I found my mail stuffed with requests for money for political campaigns this last fall. Lordy, the direct mail companies must have made a killing. Those who sent postage paid envelopes got an offer to make a $1,000 donation, but I did ask for some assurance that the candidate would be working for my benefit more than his own, so I included some minor caveats.

Like a campaign promise which would give me a guarantee that I would see some needed changes such as: (1) Term limits for federal judges, plus some guidelines for them, such as a return to the constitution instead of leading the parade for social engineering, as they did with school busing. (2) Get the government and the judges out of religious issues such as school prayer and abortion, which represent still more social engineering. Why are we even arguing about mixing church and state? The constitution was supposed to settle that. (3) The elimination of government confiscation of property through its many agencies. For instance, the property tax effectively makes the owner of property a lessee, not an owner. If you stop paying the tax, you lose your property. If an informant tells the police that you have drugs on your property the police can (and all too often do), without a warrant, break in, plant some drugs, and then confiscate your property. If the IRS decides you owe for taxes they can confiscate your property. I put my life on the line—on the front line—during WWII, but it wasn't for the America I see today. The RICO (organized crime) laws were, as usual, well intentioned. But government agencies have misused them to

Continued on page 49

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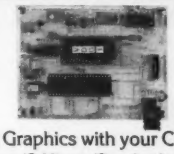

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The Solder Slurper

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Dave Evison N6GKC
153 Park Avenue
Palo Alto CA 94306

Whether you're recycling parts mounted on a PC board or repairing some electronic equipment, you want to remove the parts without ruining either the parts or the board. While there are many professional desoldering stations and aids available, most are either expensive or ineffective. Professional desoldering stations are priced from $400 and up, which is more than most of us are willing to pay.

You'll find the Solder Slurper is equal to or better than most commercial units. It uses off-the-shelf parts you can get at any Radio Shack™ and auto parts stores. And it can be built for under $60, even if you buy all new parts. However, if you get a used fuel pump and parts from your junk box, a first-class unit can be put together for just a few dollars.

The Solder Slurper is designed around an automobile electric fuel pump, associated fuel filters, and a Radio Shack desoldering iron. The rubber bulb originally used by the Radio Shack desoldering iron to create a suction for extracting the molten solder is replaced with a hose, filters and the electric fuel pump. The heated tip of the desoldering iron is placed on the joint to be desoldered, the solder is melted, then the foot switch is pushed and the pump sucks the molten solder away from the joint. The first in-line fuel filter captures the molten solder, keeping it out of the pump mechanism. The second in-line fuel filter further protects the pump by removing the desoldering fumes.

While the pump will work with any 12V supply capable of delivering an instantaneous 6A and continuous 2A, I used a gel cell with a trickle charger. Since the in-rush of current is steep when the pump is turned on, many regulated power supplies will blow fuses. If the supply incorporates a crowbar circuit it may also shut down the power supply. The gel cell battery acts as the power source, with excellent low internal resistance, and easily provides the high starting current.

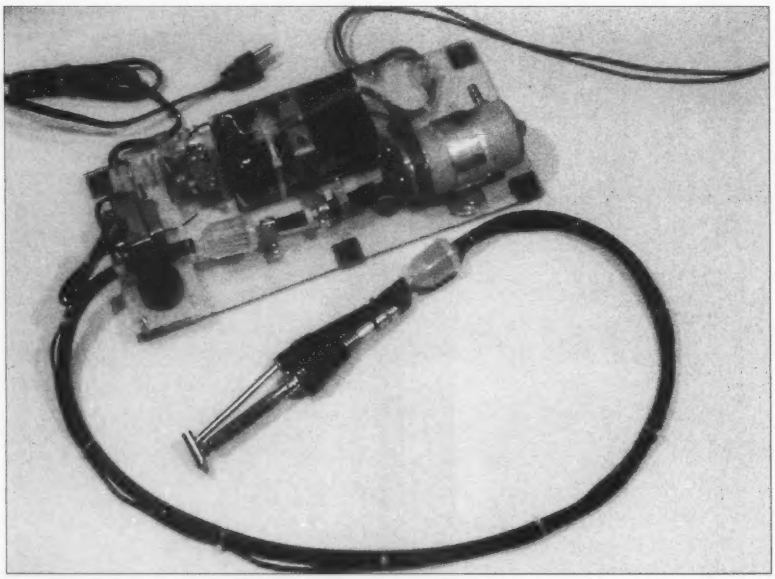

Photo A. *The prototype Solder Slurper.*

The circuit

The charging circuit is designed around a common 12.6V filament transformer and a 15V three-terminal regulator. It is designed to deliver a charging current until the surface charge of the battery equals the charging voltage of the charger (13.4V). The two diodes in the regulator output minimize the discharge of the battery through the charger, should the AC power be removed from the charging unit. The forward drop of these diodes also determines the applied charging voltage to the battery.

Since the Radio Shack desoldering iron is not grounded, a grounding circuit must be added to the soldering iron to protect sensitive parts from an electrostatic discharge. Any one of the three screws fastening the metal iron to the plastic handle will provide an easy way to ground the iron.

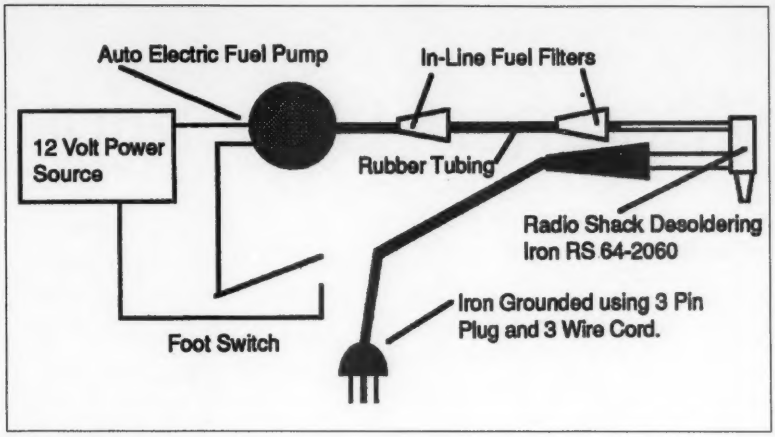
Auto Electric Fuel Pump
In-Line Fuel Filters
12 Volt Power Source
Rubber Tubing
Radio Shack Desoldering Iron RS 64-2060
Iron Grounded using 3 Pin Plug and 3 Wire Cord.
Foot Switch

Fig. 1. The system.

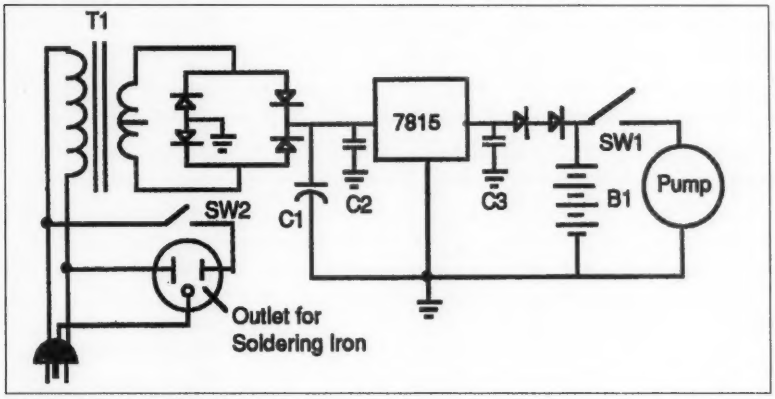

Fig. 2. The gel cell battery trickle charger.

Parts List

Desoldering Iron	Radio Shack # 64-2060
Electric Fuel Pump	Bosch GFP 221 or equivalent
In-Line Fuel Filters	WIX 33011 or equivalent
Interconnecting Hose and Clamps	
AC to DC Power Source	
T1	12.6V @ 1.2A filament transformer (RS 273-1352)
C1	250µF @ 25V
C2, C3	0.1µF @ 50V
7815	3-Terminal Regulator
All Diodes	1N4006
B1	12V Gel Cell Battery, 3Ah or greater
SW1 (Foot Switch)	SPST 10A
SW2	SPST 1A

When connecting the pump, filters, and vacuum hose to the various parts of the unit, make sure you make good vacuum-tight seals. And if you are using a used electric fuel pump, make sure there is no residual fuel or vapor in the pump. Let it run for 10 to 15 seconds to purge the pump prior to extracting solder.

As with any desoldering tool, an accumulation of solder can build up within the hollow desoldering tip and discharge tube of the iron. Heavy build-up can, over time, actually block the discharge tube, so you may have to drill out the blockage.

During heavy usage, the build-up can be minimized by frequently shaking the accumulated molten solder out the hollow tip into an old tin can and by running the pump for a couple of seconds prior to turning off the iron at the end of the day. Another useful technique to both remove the solder and free the lead being desoldered is to carefully "skate" the tip of the iron on the pad and thereby position the lead in the center of the hole.

"A first-class unit can be put together for just a few dollars."

Photo A shows the prototype Solder Slurper with the parts mounted on a piece of plastic. While the prototype is ugly, the interconnection of parts is clearly shown. If you put the Slurper in a flashy box, you could sell the units commercially.

The Solder Slurper sure is handy in my small laboratory, and its "Ghost-Buster" look always gets comments.

Columnist Needed

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Audio Filter Alignment Generator

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J. Frank Brumbaugh KB4ZGC
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The vast majority of transmit offsets for CW and SSB have been established at approximately 700 Hz. This is practically an industry standard and is also the offset used in most QRP transceivers, whether they're kits or home-brewed. Therefore, active and passive filters are most often designed to have a center frequency of about 700 Hz and the many circuits found in the ham literature bear this out.

Of course, few if any filters can boast a center frequency of exactly 700 Hz, because electronics is a world of tolerances and percentages, but all such filters will be centered very close to 700 Hz.

There are numerous circuits published for small fixed-frequency audio oscillators, usually Twin-T or phase-shift circuits. But, with tolerances and strays, it takes a lot of "cut-and-try" to get such an oscillator to produce exactly the desired frequency.

A much easier way to produce a signal at the exact frequency required to check and adjust an audio filter is to use an audio generator whose output signal is known, accurate and stable. (See "Crystal-Controlled Audio Generator," *73*, November 1995, page 28. Note: There is an error in the schematic. C11 should be connected between the emitter of Q3 and the emitter of Q2.) Although recommended as an accurate and stable generator of signals in the most useful range of 300 to 3,000 Hz, if you only need to trim your filter for a 700 Hz center frequency, this would be overkill.

"For most hams this will be a junk box project and cost nothing—and it can be constructed in an hour or two."

This article describes an even simpler and cheaper audio generator, also crystal-controlled but producing a single frequency of approximately 716 Hz (which is well within normal, even very close tolerance for the usual 700 Hz filter frequency). If this is the only audio frequency you need, you may wish to build this simple project. The output frequency is stable and accurate because it is derived from a crystal oscillator. There will be no drift of the output frequency. The crystal frequency is divided by a factor of 5,000, so the crystal would have to drift 5,000 Hz for the output frequency to vary by 1 Hz. That's *real* stability!

For those hams who need to buy some or all of the few component parts as new "surplus," the cost should not exceed about $5. For most hams this will be a junk box project, and cost nothing—and it can be constructed in an hour or two.

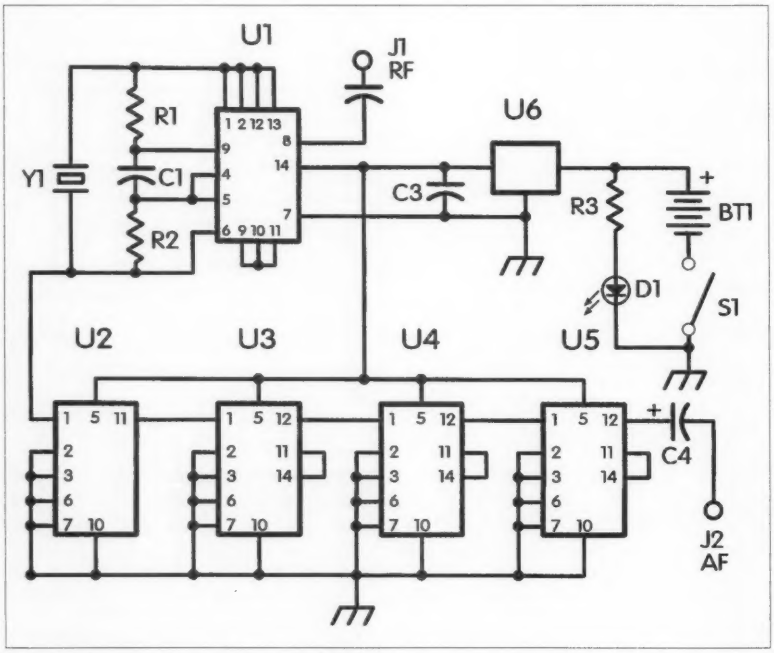

Fig. 1. *Schematic diagram for the audio filter alignment generator.*

The circuit

In **Fig. 1**, U1 is a 74LS00 quad two-input NAND gate. Two of the gates are connected to form an oscillator controlled by Y1, a common inexpensive color-burst crystal with a *marked* frequency of 3.579545 MHz. The output of the crystal oscillator at pin 6 of Ul is applied to input pin 1 of U2, a 74LS90 configured to divide by five. The output from pin 11 of U2 is applied to input pin 1 of U3, a 74LS90 configured to divide

by 10. The output from pin 12 of U3 is applied to input pin 1 of U4, also a 74LS90 configured to divide by 10. The output from pin 12 of U4 is applied to input pin 1 of U5, a 74LS90 also dividing by 10 to produce the desired output frequency of 716 Hz at pin 12. This 716 Hz frequency is applied to output connector J2 through C4, which blocks the DC voltage at pin 12 from the output connector J2.

The above describes the functioning of the primary 716 Hz audio generator. However, because a color-burst crystal is used, there is a bonus to be derived at no additional cost. The crystal frequency at pins 1 and 2 of U1 is fed through the two unused gates which are connected to form inverters, and is available through DC blocking capacitor C2 at J1, taken from pin 8 of U1. The possible uses of this harmonic-rich signal will be discussed later.

Power is supplied by BT1, a 9 volt alkaline battery, and is controlled by S1, an SPST switch. The 9V source is applied to the input of U6, a 78LO5 voltage regulator which provides a regulated positive 5 volts to all TTL chips in the circuit. C3 bypasses the output terminal of U6 to remove any digital spikes which could affect regulation. The combination of R3 and LED Dl is optional, but it draws only about 3 mA so it is recommended as a reminder to turn the generator off when not in use, to prevent draining the battery.

Construction

The circuit can be built on a piece of perfboard, a general purpose printed circuit board, or "dead-bug" style on a base of any nonconductive material such as plastic or wood. Sockets for the chips aren't necessary, but may be used if you wish. Note: It might be desirable to use sockets for the four 74LS90 chips. I have found a number of these chips, purchased from mail order vendors as "new surplus," which refused to divide. Changing chips in sockets is much easier than unsoldering their pins from a PC board.

An enclosure isn't necessary, but if you do a lot of work with active and passive filters you may wish to build it neatly in a small plastic or metal box, or one made from printed circuit board material.

Operation

Since this is a digital circuit, if the crystal is good and all chips are wired correctly and are in their designated places in the circuit, it will function as soon as power is applied.

If it doesn't work at all, or the output audio frequency is incorrect or unstable, you either have a bad crystal or one with the wrong frequency, one or more bad chips, or something as simple as a wiring error or solder bridge. If you use sockets for the chips, make certain they are in the right sockets *and* are oriented correctly. It will help if you place a dot of white paint on top of each chip at pin 1, and also on the side of the socket at pin 1.

Again, when a simple digital circuit is wired correctly, has all good parts installed correctly, and the proper operating voltage is applied, it will function as designed—period.

Using this instrument

This is a fixed frequency audio generator. Feeding its output into the input of an audio filter while monitoring the amplitude level of the filter output with an oscilloscope or a DMM on a low DC voltage range will allow tweaking the values of pertinent resistors and capacitors for maximum output voltage, resulting in the center frequency of the filter being exactly the same as the generator.

It has a number of other incidental uses as well. It can be used as a sidetone generator. It can be keyed in either the positive or negative power lead as a code practice oscillator, feeding headphones or a small speaker. It can also serve as a signal injector for aligning receiver circuits because the output is rich in harmonics.

Using the bonus frequency

The crystal frequency available at J1, which will be close to but not exactly the marked frequency of 3.579545 MHz, has strong harmonics which fall within or near every ham band from 80 through 10 meters, including the WARC bands. To be useful for calibration checking or as a signal for alignment purposes, these harmonic frequencies must be known accurately.

Measure the frequency at J1, using a frequency counter, then multiply this frequency by each harmonic number from 2 through 8 and note these frequencies for future use.

The signal level at J1 is much too high to feed directly into the antenna connector of a receiver. You can connect a short length of wire to J1 and radiate the signals to your station antenna. Another method is to disconnect the antenna from your receiver and connect a short length of wire to the receiver antenna connector. Drape this wire near the instrument to conduct its signals to the receiver. 73

Parts List

BT1	9 volt alkaline battery
C1, C2	0.01 µF ceramic disc or monolith
C3	0.1 µF ceramic disc
C4	100 µF electrolytic, 10 WVDC or higher
D1	LED, color optional
J1, J2	Output connectors, your choice
R1, R2	1k 1/4W 5%
R3	2.7k 1/4W 5%
S1	SPST toggle or slide switch
U1	74LS00
U2-U5	74LS90
U6	78LO5
Y1	3.579545 MHz color-burst crystal

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The Art and Challenge of Sending CW

When a QSO is so much more than just "RST, QTH, name and 73."

Bob Shrader W6BNB
11911 Barnett Valley Road
Sebastopol CA 95472

With Hand-Key Night coming up on December 31st it's time to get out the old hand key, rubber-cement it to the tabletop and get ready for some good old-fashioned fun-type CW QSOs. Hand-Key Night is a time when a QSO is much more than just, "RST, QTH, name and 73." It's rag-chewing. It's a time to find out what rigs are used; what bands, what type(s) of work done; when the other op was first licensed, radio backgrounds, latest travels, sports, homes, computers, animals, marital status, kids, greatest accomplishments—everything!

Amateurs know their code sending as "CW," meaning "Continuous Waves." It may surprise some newer hams that this means radio waves that have a constant amplitude (strength), and has nothing to do with how long the waves are being generated. The term developed in the earliest days of radio when code transmissions were made only with spark-type transmitters that produced decaying-strength RF "wave trains." When a spark occurred in a spark transmitter, a high amplitude RF ac was developed, at the quarterwave frequency of the antenna, that rapidly decayed to zero. Each half-cycle of the power-line ac developed a spark and RF wave train of its own. Power line ac with a frequency of 60 Hz used in a spark transmitter produced 120 RF wave trains per second. Originally, all radio communications were made using spark-type telegraphic code signals—there was no such thing as CW or radiotelephone.

When constant amplitude radio wave generators were developed and used for radiotelegraphic code, those emissions were termed CW because they were Continuous-amplitude Waves, not decaying spark-type waves. Today, the term CW has taken on the meaning of any type of radiotelegraphic code used in the MF or HF bands. However, the abbreviation "MCW" indicates an audio-frequency Modulated Continuous-amplitude Wave code signal, which may also be used by hams but only in their VHF, UHF and SHF bands.

It's a challenge

Learning to send CW correctly with any type of mechanical or electronic-aided key does not come easily. Many newer hams have never been advised by qualified CW operators, so may never have been shown how to use a key correctly. Proper finger and hand movements must be learned for whatever type of keying device is used. These correct motions must be practiced regularly to assure proper radio code sending.

Historically, the first sending device was the *hand key*, or *straight key*. The second was the *sideswiper*, *cootie key*, or *double speed key* (meaning a straight key which has two sets of contacts and sends code faster). The third was the *semiautomatic key*, or *bug*. The fourth was the electronically aided *electronic keyer*, often referred to as simply a *keyer*, or improperly as a *paddle* since bugs and cootie keys also have paddles. Keyers are somewhat similar to a bug in operation.

There is also the digital (binary/ASCII) keyboard, or *KB*, used in conjunction with some form of a computer/software system, which is not a key. A KB requires no code or keying ability to make it send CW. Its correlative, a computer with software that will decode received Morse-letter tones, also requires no code operating ability to receive perfectly generated CW letters.

The first three, purely mechanical telegraph keying devices, have been used since the mid-1800s to send "landline" railroad messages, telegrams, and stock exchange information using the American Morse code. Later they were used to send International Morse code for amateur-to-amateur, ship-to-ship, ship-to-shore, and point-to-point communications. How messages were handled is another story. This discussion is about learning to send code properly with a hand key, a bug, a cootie, and a basic keyer.

Begin with the basics

Let's start with the oldest and the simplest device, the hand key, which is supposed to be used on Hand-Key Night. **Fig. 1** shows this device in its simplest form. Such a key consists of a metal base, a metal up/down rocking arm, a spring to push the arm upward, and an adjustable stop at the back of the arm to limit how high the front of the arm will rise. It has some kind of an insulating-material knob

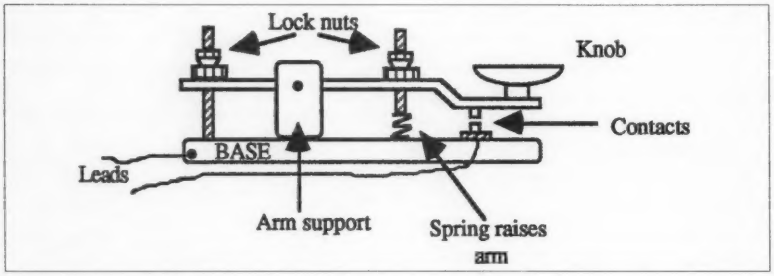

Fig. 1. *Essentials of a straight or hand key, side view.*

on the front of the arm. Most of the metal parts are electrically connected together and are connected to ground potential in radio circuits. Connected to and below the forward part of the arm is a downward-projecting upper contact. Directly below this, spaced perhaps 1/16 to 3/32 of an inch (1.5 to 2 mm), is a lower contact, insulated electrically from the rest of the key. When the knob is pressed downward against the spring's tension, it forces the upper contact to meet the lower, thereby "keying" (turning on) any circuit to which the contacts are connected.

If the knob of a hand key is pushed down only long enough to make a very short-duration contact it results in a "dot" (or short "dit" sound) being sent. If the knob is pushed down and held three times as long, it results in a "dash" (or longer "dah" sound) being sent. (This reasonably accurate 3:1 dash:dot contact ratio is the *first* challenge of sending good code letters.)

I recommend the following methods of operating keys and paddles. They are the result of five years of shipboard radio operating, four years of police radio CW, 26 years teaching International Morse code courses, and 65 years of operating on the ham bands.

One old-fashioned hand key knob has a small vertical bakelite bulb on top of a 2-inch round insulating-material bottom plate. The thumb, first and second fingers grasp the bulb. The dots and dashes are made by pumping the hand down and up (very tiring).

Modern American key knobs are usually round, flat-topped and about one inch in diameter. The method described here is for sending with the more modern key knob. In 1937, my ship, the *SS President Hoover*, was bombed by the Chinese while anchored in the Yangtze River. After sending an *SOS*, I sat and transmitted passengers' messages to the United States for five unbroken hours using such a hand key. Because the path from the *Hoover* to San Francisco (KDMW to KTK) was long, and conditions were poor on 36 meters, bug sending was out. Could you send without stopping for five hours using your present method of operating a hand key?

Here is the way to hold the knob to assure making constant-speed dots, each separated from the next by a space-time equal to the dot contact time, one of the

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challenges of good sending: The tip of the first finger should rest on the flat-top knob at about a 12 o'clock position as seen by the operator. The thumb rests against the under part of the knob at about a six o'clock position. It may seem that the knob is being *grasped* by the thumb and first finger. Actually, the touching of both the thumb and the finger is very light. The thumb's only job is to prevent the first finger from wandering off its proper position on the top of the knob. The hand should be relaxed, but held parallel to the desktop, with the palm about two and a half inches above the desktop, the wrist about an inch above it. The arm muscle near the elbow rests on the desk. (A square piece of thin carpet, or other thin padding, under this muscle makes sending a lot more comfortable.)

The other three fingers? They are allowed to hang out in the air to the right of the knob (assuming that the operator is right-handed, although lefties send just as well).

The three fingers in the air have a very important job to do. As the hand is pushed downward from the wrist and is then pushed back up by the spring, the three fingers move down and up, along with the first finger on the knob. These fingers act as an up/down pendulum when sending dots, effectively setting the proper dot-space-dot keying. Dots made this way will produce a code speed of perhaps 15 words per minute (wpm) without any difficulty.

It *appears* that the first finger, or maybe the second, is doing the downward pushing, but actually it is the whole hand. In proper keying, when the key contacts close, your wrist should move upward slightly as the closing of the key contacts stops the downward movement of the hand, raising the wrist. Make *sure* your wrist does this. It is important! If your wrist goes down when your fingers go down you are not relaxed and you are making work out of what should be fun. You are sending with your whole forearm and not just with your hand and fingers. If you send several dots in a row your wrist should rise perhaps a half inch farther above the desktop.

To send faster than about 18 wpm, put both first and second fingers on the knob top. Now only two fingers are acting as a pendulum, allowing a faster up-and-down motion, and faster dots.

How tight should the key's spring be? This is a purely personal decision. Adjust it so that the key's movement feels neither too stiff nor too limp. The contact gap is also a personal preference setting. Try a gap of 1/16 to 3/32 inch (the thickness of three or four QSL cards?). Don't make it too small—you want a good up/down movement of your hand, not a nervous tremor.

(Practice the following: Using your key and a code oscillator or buzzer, send a series of about 100 dots a few times until you get a feeling for the proper pendulum action of your three outer fingers. Keep your hand parallel to the tabletop at all times.)

How about dashes? There's nothing automatic about them; dashes depend entirely on your sense of timing. The pendulum motion of the fingers may help to make dots but not dashes. The wrist should move upward slightly with every dash. Be careful—there is always a tendency to make dashes too short. Concentrate on making your dashes a little longer than you think they should be. With practice the dashes will shorten to a more correct length. If you have a transmitter and an oscilloscope that can show your RF output, connect a dummy antenna to the transmitter and watch the scope. If the horizontal sweep is adjusted to the correct speed you will be able to see the relative lengths of your dashes and spaces. The space between dashes should be one-third the length of a dash. And this should also be equal to both the length of a dot and the space between dots or dashes.

(Practice the following: Make a long series of dashes, trying to make the dashes all the same length and a little more than three times the length of the spaces between them. Yes, it's a challenge.)

One important point: Do not allow your finger to rise off the surface of the knob while sending. You should never be *tapping* the key. Push the knob down and let the spring return your finger upward without your finger losing contact with the knob top.

A good preliminary practice for making letters and numbers is to practice making a string of perhaps 50 dahdidahs—then a string of 50 didahdits—then 50 didahdahdits—then 50 dahdididahs—then 50 dididahdahdidits—and so on, until you are making strings that include five dots and then strings with five dashes in them.

Normally a hand key can be used for speeds up to about 18 wpm (to perhaps 23 wpm with two fingers on the knob.) If you want to go faster than about 20 wpm with purely mechanical keys, you might use the old-time sideswiper, cootie, or double speed key, shown in **Fig. 2**. It consists of a horizontally movable spring-steel arm that returns the arm to a central resting position when not pushed to either side. The steel spring is anchored at its far end to a post on the metal base that is normally at ground potential. The length of the arm-spring determines the stiffness of the side-to-side, or lateral, movement. A bakelite paddle, about an inch and a half long and three-quarters of an inch high, is attached to the arm's near end. To both right and left of the arm are adjustable screw contacts that are insulated from the base. The contacts are adjusted so that the arm must move about 1/16 to 3/32 of an inch from its resting position to strike either the right or the left contact. A quick push to the right will produce a dot. Hold it a little and the result is a dash. The same is true pushing the paddle over to the left contact. (It is actually a double horizontally-operated hand key, using both finger and thumb to make dots and dashes.)

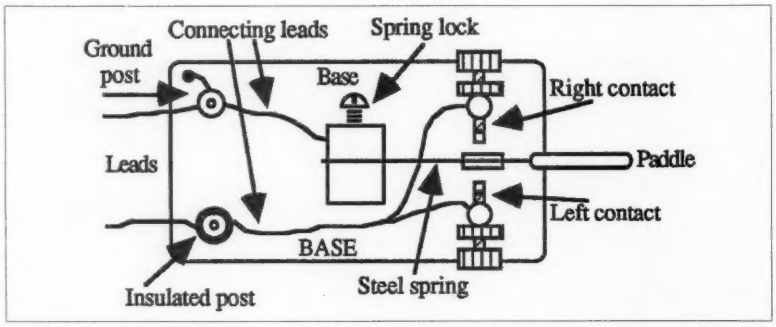

Fig. 2. Essentials of a sideswiper, double speed, or cootie key, top view. (If the right contact post is disconnected from the left, this could be the paddle of a simple electronic keyer.)

With a cootie key, if you move your finger and thumb back and forth rapidly several times you produce a series of dots. If you hold the contacts longer, you produce a series of dashes. A quick contact to the left followed by a longer contact to the right produces an "A." Similarly, a quick contact to the right followed by a longer contact to the left also produces an "A." (It takes a lot of practice to make these monsters put out good Morse code!) You have to be able to send both dots and dashes with both thumb and first finger. (Should a cootie key qualify for Hand-Key Night?) To learn to send with a cootie use the same didah practice suggestions above.

The cootie key represents the greatest challenge of any of the mechanical keys. Sideswipers were used in early RR and radio days because they were cheap and easy to construct. They are both easier to operate and will send faster than a hand key does, but relatively few operators use cootie keys today. You can usually recognize cootie operators by the "swing" (slight variations of dot and dash lengths) that becomes unique to each operator. Swing gives a special character to sending, setting the operator apart from the machine-like perfectly-spaced sending of electronically aided keyers and keyboards. (Unfortunately, commercially made sideswipers are no longer available but they're easy to put together from parts out of most junk boxes.)

The best hand position for the sideswiper and other side-to-side keys is to rest the right edge of the hand and the first knuckle of the little finger on the tabletop, rotating the upper part of the hand as well as pushing the thumb and first finger from side to side to make the dots and dashes. (An anchored hand position was a necessity for operators aboard rolling and pitching ships!) Don't be afraid to hit the paddle reasonably hard. This makes good solid letters.

The cootie is a good mobile CW key. A sideswiper can be used for code speeds in excess of 23 wpm without much difficulty.

Unlike using a hand key, neither the first finger nor the thumb should rest with any significant pressure on any side-to-side operated paddles, but they must never be far from it. When the thumb is pushing, the finger will be off the paddle, and vice versa. If paddle-type keys are not anchored, they will move when the paddle is pushed. To prevent this, coat the feet of such keys with rubber cement to secure them to the tabletop. Cemented down, they will take quite a beating without coming loose, and rubber cement is easily removable, leaving no residue.

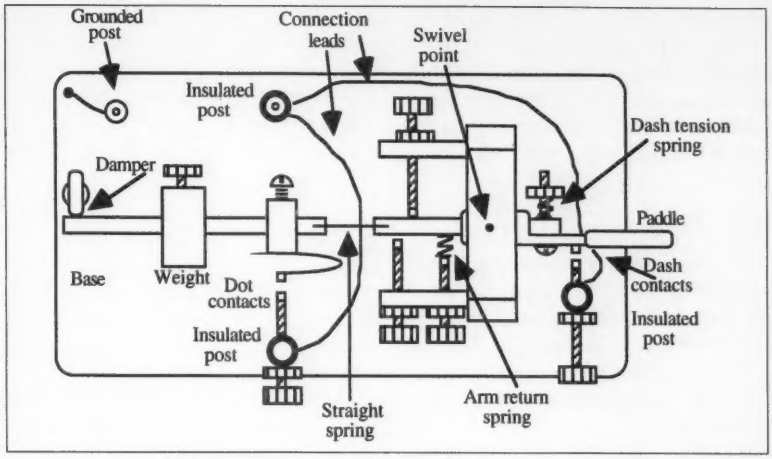

Fig. 3. Essentials of a semiautomatic key, or bug, top view.

The easiest mechanical key to use for speeds up to 40 wpm by good operators is the semiautomatic key, or bug, shown in **Fig. 3**. (It is shown with a simple, single paddle, although more complex paddles are also used.) The bug is a little like a cootie key. However, a bug has a straight spring at the end of its first horizontal-moving arm, which in turn is attached to a second, weight-carrying rod. This last rod can be made to vibrate side to side in pendulum fashion. Each time its U-shaped dot-contact spring hits the dot contact on the insulated post at the left, its vibration makes dots as long as the paddle is held to the right by the thumb. A quick push produces one dot; a slightly longer push produces two dots—a still longer push produces three dots, and so on.

Pushing the bug paddle to the left with the first finger connects the arm to a contact on a second insulated post. This sideways finger push makes dashes essentially the same as a downward-pushed knob makes dashes with the hand key. (When bug operators want to send code slowly they may use the dash paddle as a side-operated hand key.) The bug only makes dots automatically—it's up to the operator to make the dashes properly, in both number and length. The contacts on the dot and the dash posts are connected together electrically and are brought out at the insulated output binding post. The other output binding post is connected to the metal base. As with the cootie key, bugs should be whacked fairly hard to make sure that good solid dots and dash contacts are made.

Bug adjustments are more complex than those of hand and cootie keys:

•1. Whenever the paddle is released, the arm-stop screw at mid-right must be set to just stop the swing of the vibrating arm against the damper mounted at the far back edge of the bug. With the damping position fixed, the locknut on the arm-stop screw is tightened so the adjustment cannot change.

•2. Adjust the dash paddle swing at front left for a spacing of 1/16 to 3/32 of an inch and tighten the locknut.

•3. The dot-arm stop screw at mid-left is set to about 1/16-inch spacing and its locknut is tightened.

•4. The mid-left dot-arm spiral spring is tightened or loosened to a comfortable paddle feel.

•5. Move the weight (or weights) on the vibrating arm to the far end of the arm and tighten. This produces the slowest pendulum movement and therefore the lowest speed dots.

•6. Connect the bug across an analog ohmmeter. Push your thumb solidly against the paddle and watch the

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ohmmeter indicator needle. Adjust the U-shaped spring's dot contacts until the needle vibrates at mid-scale, indicating the dot and space times are equal. Theoretically, this is the correct setting, but slightly longer dots than spaces are easier for distant stations to read. Therefore, adjust the dot contact so the meter needle vibrates at a point a little to the right of vertical or mid-scale. (When properly adjusted, the bug should make about 10 good sounding dots before it goes into a solid contact.) The dot contact can also be set by watching a scope while the transmitter is keyed into a dummy load.

With bugs, the tendency is to set the dots at too rapid a rate. Listen to your fastest *comfortable* hand-key dot speed, and adjust the bug dots to just a little faster than that. When you have perfected your bug sending at about 18 wpm (when you can send out of a book for one minute at 18 wpm without making a single mistake), then you can increase the dot speed for faster sending. Practice operating a bug using the same didahdidah suggestions made above for the hand key.

Remember a good old Code Sending Law: "It is unlikely that you will send well at speeds faster than you can receive well." Don't try to impress other operators by using high-speed dots—you can't kid them for long about your CW ability. On the other hand, if you can obviously receive and send faster than the other operator, slow down to a speed he or she can handle or you'll be wasting your time sending information not being copied. Remember, many slower operators can produce interesting, worthwhile QSOs.

A good operator can set his bug dots for about 30 wpm and never change them. If the receiving operator can only receive 18 wpm, the bug operator can put greater space between letters and words so that the average speed is only 18 wpm. This provides good practice for the other operator to copy more rapidly made letters. If the sending operator never has to change the speed, more error-free sending is possible.

Bugs may generate dots automatically, but it is still up to the operator to make the dashes three times the length of the dots. A newer post-WWII development is the fully automatic electronic keyer. Through the operation of its internal electronic circuits, when the thumb is pushed against the bug-like paddle, a continuous string of perfect dots is produced. Pushing the first finger against the paddle makes a continuous string of perfectly made dashes exactly three times the length of the dots.

Although dots and dashes can be made more perfectly with keyers, inter-letter and inter-word spacings are still important for readability. Using a dot time as the unit of measurement, inter-letter spacing should be three units long, inter-word spacing five units long, and inter-sentence spacing seven units. There is still a challenge to send good Morse code even with keyers.

If you have a keyer and would like to try operating it as a sideswiper, many keyer paddle assemblies can be clip-lead connected so that they can make a hand-key type contact when pushed either to right or left. The paddle can then be plugged into the hand-key jack and used as a cootie key (if your keyer is built into your transmitter, or is a self-contained operating unit, this will probably not be possible).

During a QSO, if you have to stop to think while sending, try to do it between words—don't do it between dots and dashes in letters.

Never break up a letter by leaving excessive space between dots and dashes in it somewhere. If you happen to do this, make the error sign (eight dots) and go back and resend the whole word in which you made the error. Try to make the dots/dashes of all letters together to form one tied-together sound, leaving a noticeably longer space between one letter and the next. Similarly, each word should be an unbroken unit of sound.

Use abbreviations sparingly—rarely will they save much time. More likely, the confusion developed by your not sending complete words will puzzle the other operator. When a letter in a word is interfered with by static, it is far easier to guess what the missed letter of a spelled-out word might be.

To make *perfect* dots, dashes, letters and spaces there is the computer keyboard program. When you type "CQ CQ" you transmit a perfect "CQ CQ" with perfect inter-letter spacing of three dots, and when the space bar is struck you get a perfect five-dot spacing if you are typing properly. To become a good keyboard operator you should probably attend a secretarial school to learn touch typing so that you can keep ahead of the speed you choose to send in real time on the air. If you can't type properly, if you have to hunt and peck, you will leave many spaces in words where spaces don't belong. High speed Morse code in which inter-letter and inter-word spacing is incorrect, or words are misspelled, is very discouraging to good receiving operators. Keyboards are great—if you know how to use them properly, but they don't provide much challenge.

Because keyboards do provide perfect sending of plain language material typed into their memories or buffers, they are used to provide perfect code speed practice to over 100 wpm! Without a source of perfect high speed transmissions there was no such practice available, but today, high speed copying ability can be checked easily by having an amateur listen for a few minutes to a high-speed plain-language CW transmission, and then summarize what was transmitted. High speeds around 100 wpm are too fast for ordinary people to copy onto paper. For high-speed communicating, CW keyboards only substitute the Morse code for the Baudot code of radioteletype, AMTOR, or the ASCII code, but the AFSK used with RTTY, etc. is considerably superior to electronic CW signaling if there is external noise present.

With the proper software program and electronic equipment coupled to a computer it is possible to display received Morse code words and sentences on a monitor screen (such programs will copy Morse code poorly if it is not sent perfectly).

The old-time American Morse code that used to be heard on the ham bands at times used different spacings in some of its characters and different length dashes. These could be made with hand keys, bugs and sideswipers, but not by keyers or by keyboards using the usual computer CW software. Too bad. It has caused the demise of that early-day, historical telegraph code.

If you like challenges, see if you can learn to send Morse code well with all three non-electronic keys! Let's all help keep ham radio's original means of communicating on the air—and try to interest *others* in participating more in the fun of good radio code operating. See you on Hand-Key Night this December 31st! 73

NEVER SAY DIE

Continued from page 39

confiscate property. (4) The "war on drugs" has been a very expensive war and the government has lost it. This has been an enormous government fiasco. Get the government out of this mess and let the capitalist marketplace take over. (5) Get the government out of supporting prices. Let the market control prices and stop subsidies for tobacco, farmers, sugar, power, and so on. (6) The most expensive war in the history of our country has been the "war on poverty." The government, both state and federal, should get completely out of this failed social engineering project and let the market handle it. A number of people in government seem not to have noticed that socialism has failed in every country where it has been tried. They should be forced to visit some countries where it has been implemented, such as Russia, Yugoslavia, Sweden, China, Sudan, etc. I have. (7) Socialism has failed us in our school system. The law forcing kids to go to school is tantamount to slavery. With government-run schools costing two and three times as much to run as private schools, it is time for the government to get out of messing up the education business and let competitive for-profit forces provide this service. Our country had a much higher literacy rate before public schools were forced on us. (8) It is federal and state regulations which have made such an incredible mess of our so-called health care system, making it one of the most expensive in the world, yet providing us with third-world grade health care. Get the government out of this social engineering and let the market control our medical industry. (9) With lobbyists in every state capital and Washington, I would like to see an enforced law prohibiting any representative of the people from publicly discussing or voting on any matter in which they have a pecuniary (conflict) interest. Thus, if they accept money or favors from any person or group, they would be prohibited from being a paid agent of that person or group toward initiating or changing the laws possibly affecting that person or group. (10) Illegal immigration is against the law. Either change the laws or enforce them. Until the government social engineering projects providing free food, housing, money, education, and health care for illegal immigrants are ended our country will continue to be a powerful magnet for illegal immigrants, with the rest of us paying the bill or being put in prison for non-payment of ever-escalating taxes. (11) There's more, like our expensive postal monopoly, but that will give you an idea of the platform I would be delighted to support with my money, just as I believed I was supporting these concepts when I put my life on the line in WWII.

Scientific Evidence

Do you personally have to see something to believe it? Supposing the same event is reported by a number of people who have had no way to get together to concoct the story? Scientists have a problem believing in anything they can't reproduce on demand with 100% reliability, yet there is a wide variety of things going on which don't fit in with those restrictions. And, of course, if we get into religion or politics, we run into many areas of strongly-held beliefs that have no scientific support.

While I've always had an interest in the occult, UFOs, and other anomalies, I've been annoyed by the closed-mindedness of many people who reject the experiences of others. When something unusual happens, my instinct is to investigate it and try to understand what's going on, not to make every effort to reject or ignore it.

Scientists tend to sweep the unexplainable under the rug as "anomalies." For them that's enough of an explanation, and never mind trying to understand the anomaly or reproduce it. Doctors have the same mind-set, sweeping aside sudden cures for fatal illnesses as "spontaneous" cures. Thus, instead of trying to find out what in the heck brought about the "spontaneous" cure so it could be used to help others, they close their mental doors.

For thousands of years people have been reporting near-death experiences (NDEs). There's a magnificent book by Dr. Crookall, *The Supreme Adventure* (1961), which examines hundreds of NDE reports and shows how remarkably consistent they are. He then takes the next step and examines hundreds of reports from the "next world" as received through mediums. These, too, are consistent with the NDE reports. It's almost enough to make a person think.

I've read three recent books you might want to look for. There's Dannion Brinkley's *Saved By The Light* (1995; 204p), where he was struck by lightning and had quite an NDE. It's worth the $6. Unlike most other visitors to "heaven," Dannion claims to have been given some glimpses into the future. If you've been keeping up with the latest in technology you'll find his piece on the coming development of DNA-type computer systems most prescient for a 1975 NDE experience.

Then there's Mally Cox-Chapman's *The Case For Heaven* (Putnam 1995; 203p; $30). She goes into detail about her own experience, and then tells the stories of dozens of more people she's interviewed who've had similar experiences. Having gradually become an old man, and thus perhaps a little more concerned with death, these "light" books are of increasing interest to me.

There's Betty Eadie's *Embraced By The Light* (1994; $6; 145p). You should be able to whip through it in less than an hour. She puts more of a religious interpretation on heaven than most others who've been through the experience, but her story is quite similar to all the others in most respects.

Another NDE resource is Cherie Sutherland's *Reborn In The Light* (1995; $6; 303p). Like the others, she reports on a number of people she's interviewed. Their stories are remarkably similar. There is the pattern after the NDE of no longer fearing death, but

Continued on page 61

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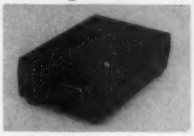

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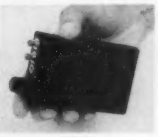

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Join the North Pole Network

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April Moell WA6OPS and
Joe Moell KØOV
P.O. Box 2508
Fullerton CA 92837

We discovered the joys of ham radio Santa visits 20 years ago when April was a department head at a large hospital. One December day, she heard that a group from a prominent Los Angeles area ham club would be coming that evening to let the Pediatric unit children talk to Santa. She phoned the club's contact person and volunteered to serve as a hospital liaison.

Only one ham from that club (Jack Lemaster WB6ECB) showed up. Rather than disappoint the kids, the three of us put Santa on the air. That hooked us; we've done it every year since. We have lots of help from the hospitals and from members of the Hospital Disaster Support Communications System (HDSCS), an Amateur Radio Emergency Service unit here in Orange County. Even though Jack has moved out of the area, he occasionally comes back just for this activity.

Photo A. *"Santa knows me!" This moment of surprise is the best part of every QSO with St. Nick. April Moell WA6OPS holds the mike.*

Personalize it

Everyone loves to be called by name. What could be a greater thrill to a youngster at Christmas time than to have Santa himself recognize you? That's exactly what happens when HDSCS visits Children's Hospital in December (**Photo A**). After the roving operator is introduced to a patient, the radio call is made: "Calling the North Pole! This is WA6OPS in Orange County, California. Santa, we're in room 217 of Children's Hospital by Bed 2. Do you know the little girl here?"

"Patient #1 bounced up and down in his bed and shouted, 'That's the Man! That's the REAL one!'"

For a few seconds, her receiver emits the sound of reindeer, sleigh bells, the cold north wind and then, "Ho, Ho, Ho! Merry Christmas, Jennifer! How is Chips, your new little puppy?"

Jennifer is an instant believer. Santa has established his credentials in a big way, thanks to earlier sleuthing by hospital elves. Over the past week the nurses and therapists quietly collected information about every patient to be visited. It doesn't take a lot—just enough to assure the youngster that Santa is for real.

Even the most skeptical kids are hooked by a well-prepared Santa. In one four-bed room, patient #1, an eight-year-old boy, feigned great disinterest as we came in, so we talked first to the others. He perked up noticeably as Santa greeted patient #2 with his name and some personal information. As Santa next gave a similar hello to patient #3, patient #1 bounced up and down in his bed and shouted to patient #4, "That's the Man! That's the REAL one!" He could hardly wait for his own turn.

Of course, information gathering must be done inconspicuously by the staff. Usually there is useful data in the medical chart and their own notes. Santa can make use of the child's name, age, nickname, grade in school, family members, pets, a favorite toy or food, special interests, etc. Only a few of these items are necessary for any particular child.

If it would be helpful to have words of encouragement from Santa and Mrs. Claus such as, "Work hard in your physical therapy," let Santa know in advance. Of course, Santa should never promise to bring specific gifts, but if it is known that a certain item is planned for a child, it might be appropriate for Santa to comment that "The elves are working on it in the workshop." Elves should be sure to let Santa know of any sensitive matters. For instance, you don't want him to mention Dad when a Dad doesn't exist.

Most of our elf work is done before the hams arrive, but it's also good for Santa to have last-minute intelligence to fill in the gaps. A "spy elf" goes along with our ham entourage from room to room. She quietly observes what the kids are wearing, what decorations are in the room, what they are doing, and what family members are

present. Then she goes outside the room and surreptitiously clues another elf at Santa's communications center,, who relays the information to Santa (**Photo B**).

The staff at Children's Hospital loves elf work and looks forward to the hams' coming. Sometimes they even sneak in a little "behavior modification." When Santa greeted one little boy by name and asked if he was still sucking his thumb, the thumb shot out of his mouth and stayed out for the remainder of the visit.

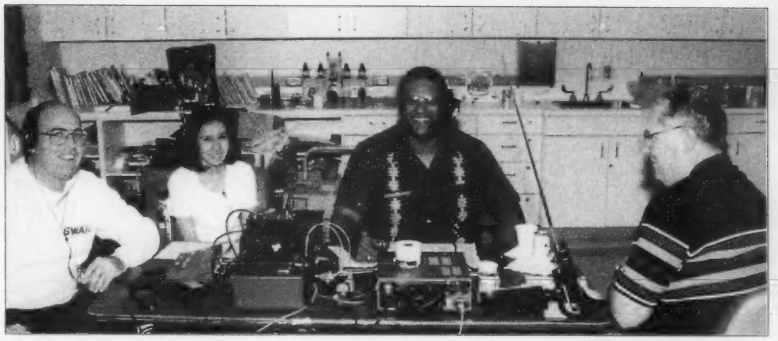

Photo B. *In a secret location within the hospital, Santa's helpers handle the North Pole linking and elf work. Left to right are Tom Gaccione WB2LRH, an unnamed hospital volunteer, "Woody" Woodward KJ6LE and Ken Simpson N6IDE.*

Gifts for the kids

We have heard of groups that give out candy canes after each Santa QSO, but they risk protests from the nursing staff. Sweets may violate dietary restrictions and can be an infection hazard for patients in isolation. Small toys or stuffed animals are better. Of course for infants and toddlers these items must be "kid-proof," with no parts that can be pulled off and ingested.

For the past 12 years, we have given out two-inch round buttons that read, "I talked to Santa on Amateur Radio." Everyone loves them, including parents and nurses, who frequently ask if they can have one, too. (Sure, if they talk to Santa!)

These buttons are great publicity for our hobby. The patient and his entire family are reminded that amateur radio is the service that brought them St. Nick. In the early years, we heard ourselves referred to as "the CB group that talks to Santa Claus," despite our educational efforts. Since we started passing out the buttons, the confusion has stopped and they have become collectors' items.

Such buttons are easy to obtain and are popular with youth sports leagues. Your club may have a member with a button-making machine; the cost of materials is not high. Another alternative would be an adhesive sticker, about the size of a name tag, with the same words.

A new name

Old-timers say that this activity has been going on in Southern California for 40 years, traditionally called "Operation Santa Claus." Tradition is nice, but we stopped using that name long ago. It was causing confusion to hams and non-hams alike. At least one of the military services and several other organizations here have used this same name for their holiday charity efforts for many years. When we would mention our "Operation Santa Claus" activities, listeners immediately assumed we went around collecting toys.

Today we use a much more descriptive title: The "North Pole Network." In news releases, we call it the "North Pole Amateur Radio Network" for further clarity. If you like this name, we encourage your group to adopt it.

We nixed the boob tube

After our first year of Santa hospital QSOs, we got the bright idea of using 430 MHz ham television (ATV) to let the kids see Santa as they talked to him. The next year Santa transmitted on that band and we lugged a cart with a TV set, ATV receiver and yagi antenna from room to room. Multipath propagation of signals through the hospital corridors resulted in noisy ghosting video. The kids weren't impressed.

For the next several years, Santa was visible in each kid's room via the hospitals' closed-circuit TV systems. Video and audio quality was much better, but Santa had to be on camera for almost three hours as the radio operators went room to room. Besides being hard on Santa, who had to "mug" for the camera in between QSOs, it meant we could not covertly give Santa last-minute elf information, and we found ourselves putting on a full-blown TV production each year.

Nowadays, we use radio only. Santa likes it better, because he can concentrate on talking to the patients and not worry about his appearance. The kids are just as happy, because their imaginations can create a better Santa image than we could ever provide.

To ensure good radio coverage of each room, we put Santa in an out-of-the-way office within the hospital. The link is on an obscure simplex frequency, rather than a repeater. This has eliminated inadvertent and malicious interference, which could ruin the event and be an embarrassment to both hams and hospital staff.

We have discovered that 223 and 440 MHz are much better for Santa communications than 2 meters, for two reasons. First, UHF signals propagate much better than VHF within the halls and floors of hospitals. Second, computerized hospital equipment often radiates "birdies" that cause loss of receiver sensitivity at 144 MHz, but they are usually not present on higher bands.

Include all ages

Everyone wants to be nice to kids at Christmas. North Pole Network is just one of the many events at Children's Hospital of Orange County every December. There are carolers, clowns, firemen, and so on. But who brings holiday joy to older hospital patients?

Christmas time is an emotional roller coaster for a patient with a physical disability. The joy of the season can be offset by the miseries of infirmity and loneliness. You might not think that a talk with Santa on radio would mean a lot to a teenager, a middle-ager, or a senior citizen. After all, the patient is old enough to realize that Santa isn't really 3,800 miles to the north. But for many, this annual visit is a real uplift.

The patient is cheered by the friendliness and by the fact that a group of strangers thought enough of him or her to put on a special program. All the wonderful

memories of Christmases past are rekindled. As one elderly gentleman exclaimed into the mike, "Santy, it's good to talk to you again. You and I go 'way back!"

Getting in the door

If someone in your club is or knows an employee of your local hospital, have that person find out whom to contact to arrange for a North Pole Network visit. At large children's hospitals, ask for Recreation Therapy or Child Development staff to assist.

At most local community hospitals, you will have the best results by starting with the public relations department. These employees often arrange visits from local volunteer groups such as Christmas carolers and firefighters. Keep in mind that many facilities have only a few children in the Pediatrics unit. As Christmas approaches, most will be sent home if possible and only the sickest will remain hospitalized. Consider visiting both adults and children at these locations.

Hospitals with rehabilitation centers usually have Recreation Therapists who arrange special activities for patients. If there is no Recreational Therapy department, contact the Occupational Therapy department. Convalescent or skilled nursing facilities have an Activities Director or Recreation Leader. These people are always looking for activities for their patients and if you present North Pole Network appropriately, they will be delighted to plan for your coming.

"One elderly gentleman exclaimed, 'Santy, it's good to talk to you again. You and I go 'way back!'"

Most hospital staff have no or little familiarity with amateur radio. It is important to meet with staff beforehand to acquaint them with what you want to do. Show them this article and tell them about your previous North Pole Network experiences, if any. Demonstrate the equipment you plan to bring into the hospital.

Be prepared for some hesitancy. Most hospitals are concerned about interference with their medical equipment. Assure them that ham hand-helds are not like cell phones (usually banned in hospitals). Experience has shown that the potential for interference is very low. But if they do not want you to transmit from rooms with respiratory equipment or specialized monitors, comply with their requests without argument. Always use the lowest transmit power possible. Use a speaker-mike on your hand-held and sterilize it with alcohol as directed by the nurses when you visit patients in isolation rooms.

As North Pole Network veterans, we know what a wonderful feeling this program can give to hams, patients, and the hospital staff. We hope your club will join the fun this year.

April Moell WA6OPS is head of the Hospital Disaster Support Communications System (http://members.aol.com/emcom4hosp on the Web). Her E-mail address is emcom4hosp@aol.com. Joe Moell KØOV is *73*'s "Homing In" columnist. No, he doesn't play the part of Santa. 73

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CARR'S CORNER

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One of the nice things about ham operators is that they have a lot of technical interests, some of which are related to ham radio, and others which aren't so related. I've come across a series of products that will meet both classes: the Speake & Co. FGM-x series of magnetic sensors. These sensors are distributed in the United States by Fat Quarters Software [24774 Shoshonee Drive, Murrieta, CA 92562; 909-698-7950 (voice) and 909-698-7913 (FAX)].

There are several different sensors in the series, and these are designated models FGM-1, FGM-2 and FGM-3. **Photo A** shows the Speake FGM-3 magnetic field sensor. It is 60 mm long by 15 mm diameter (2.36" x 0.59"). One of the other sensors in the series is a bit smaller.

The FGM-3, which I have a sample of, is a three-lead device. A set of three wire leads provides connections to make the sensor operational: red +5 VDC; black 0 volts (ground); white output signal (TTL compatible).

The output signal is a frequency that is proportional to the applied magnetic field. The magnetic detection rating of the device is ±0.5 Oersted (±50 μTesla). This range is said to cover the range of the Earth's magnetic field.

Multiple FGM-x sensors can be used to provide such things as compass orientation, three-dimensional orientation measurement systems, and three-dimensional gimballed devices such as virtual reality helmet display devices. It can also be used to provide magnetometry (including Earth's field magnetometry), ferrous metal detectors, wreck finders (diving enthusiasts take note!), conveyer belt sensors or counters, and a host of other applications where a small change in magnetic field is the important transduction event.

One way that hams can use the FGM-x series of sensors is as a magnetometer used to correlate fluctuations in the Earth's magnetic field to propagation changes. Some hams use an array of instruments to study radio propagation. I've seen (or heard of) the use of Geiger counters, 15 to 33 kHz VLF receivers, HF receivers permanently tuned to a station like WWV, and a species of home-brew magnetometer called the "jam jar magnetometer." The Speake/Fat Quarters FGM-x series of sensors can be used to replace the "jam jar." It might be interesting to see what can be learned by having a radiation detector, VLF radio detector, WWV receiver and FGM-x magnetometer collecting data in parallel. With the modern, low-cost data acquisition capabilities of computers, it should be easy to collect such data round-the-clock.

Also, I've noted that the 8088-based "XT-class" MS-DOS computers, which don't run Windows©, can be used for such monitoring with the simple addition of one of those multichannel A/D converters that operate from the parallel printer port of the computer. Those XT-class computers can be obtained in a price range from free to about $50, with hard drives in the 20 mbyte to 100 mbyte range. With such a low cost data acquisition platform, one need not worry about a distant lightning burst generating a line transient that snuffs out the computer. If it does, then so what? Buy another $50 wonder machine and go again.

The FGM-series device output is a +5 volt (TTL) pulse whose period is directly proportional to the applied magnetic field strength. This relationship makes the frequency of the output signal directly proportional to the magnetic field strength. The period varies typically from 8.5 μS to 25 μS, or a frequency of 120 kHz to 50 kHz. For the FGM-3 the linearity is about 5.5 percent over the ±0.5 Oersted range. Speake and Fat Quarters literature claims that these sensors are superior to Hall effect devices because they have a much better temperature coefficient.

In addition to the FGM-3, there are also the FGM-1 and FGM-2 sensors (which should be available soon in the USA). The FGM-1 is a smaller version of the FGM-3, with a range of ±0.7 Oersted (±70 μTesla). It is basically the three-terminal FGM-3 device, but in smaller form and with a fourth lead wire to permit feedback for linearity improvement and zeroing of the output frequency under external control.

The FGM-2 is an orthogonal sensor that has two FGM-1 devices on a circular platform at right angles to one another. This orthogonal arrangement permits easier implementation of orientation measurement, compass and other applications. One possible application that intrigues me is as an antenna orientation sensor. Also, it occurs to me that the orthogonal sensor might be used to cancel out the effects of local magnetic sources other than the desired one, such as a guard antenna on an array might do.

The price of the FGM-3 is $36.50 as of this writing. There is also a high sensitivity, limited range device called the FGM-3h for $38.75. Shipping and handling is $2 for the first item, and $1 each for additional item in the same package. The price of the FGM-1 is $36.50, and FGM-2 is $54.75. Keep in mind that these are imported sensors, so the vagaries of the currency exchange rate could affect the actual price. If you order now, I suspect that the prices quoted in their literature (and reproduced above) are valid, but if you wait a while, until they have to restock, then you will risk an increase in price as the dollar and pound sterling move relative to each other.

Special IC devices for the FGM-3

Speake also offers a series of special purpose integrated circuits that interface the FGM-x series of sensors to other things. One that I've had some experience with is the SLC-006 device. It can be used with a DAC to produce an analog voltage output, as well as alone if you want an eight-bit binary digital output.

Photo A. The Speake FGM-3 magnetic field sensor.

The other IC devices intended for use with FGM-series sensors are the SCL001 magnetic field nulling system and gaussmeter, the SCL007 high sensitivity gradiometer and magnetic anomaly detector, and the SCL002 vehicle detector. Fat Quarters has developed a printed circuit board for the SCL-006 device and can supply it in either kit form or built. Give 'em a try.

High school science teachers might want to keep the FGM-x series of sensors in mind for classroom demonstrations, and for their students' science fair projects.

Note: The applications literature for these devices is available from Fat Quarters Software (see address earlier). You will find that the circuits use the European method of specifying components. For example, a 4.7 μF capacitor is listed as "4μ7"; a 0.47 μF is "μ47"; a 4.7k ohm resistor as "4k7"; and so forth. They also use the units nanofarads (nF), which may be unfamiliar to North American readers. One nanofarad is 10^{-3} microfarads, so 1 nF = 0.001 μF = 1,000 pF. When you see a "1N5" capacitor listed, it is 1.5 nF or 0.0015 μF.

Write to Fat Quarters Software for their catalog sheets and tell Erich Kearn "Hi" from me. 73

HOMING IN

Radio Direction Finding

Joe Moell P.E. KØOV
PO Box 2508
Fullerton, CA 92837

Globetrotting Foxhunters

Enhancing international goodwill is one of the main reasons ham radio exists. The words are right there in the Basis and Purpose paragraph of the FCC rules governing our service. The many good deeds of hams in the past have helped protect our bands during international spectrum allocation conferences.

Most hams think international goodwill only refers to DXing, contesting, and emergency relief communications on the bands below 30 MHz. But you don't have to upgrade to General Class or higher to be an ambassador for ham radio. Even if you're still studying for your license, you can get involved in radiosports and compete in a worldwide arena.

Regular "Homing In" readers know that radio-orienteering is a growing sport for all ages. At international style "foxhunts," a number of low-power transmitters are hidden in a large wooded area. Using simple radio direction finding (RDF) equipment, along with a map and compass, competitors attempt to be the first to visit all of the "fox" transmitters and get to the finish line.

For all the basics of radio-orienteering, which is often abbreviated ARDF, read "Homing In" for December 1995 and January 1996.

***Photo A.** Fifteen-year-old Steve Ewing KB7MFO went on his first foxhunt in Khabarovsk. Though inexperienced, he was speedy and ended up being the second-best American finisher. (Photo by WA7VTD.)*

There you will learn about efforts to hold international-rules foxhunts here in the USA. This month, I'll cover championship foxhunting worldwide and tell you about stateside hams who are going abroad to get involved in it.

Portland pioneers

Seven years ago, a group from Portland made ham radio history by being the first from our country to participate in a multi-nation foxhunt. The event was held in Khabarovsk, a city in Asiatic Russia, under the auspices of the Friendship Amateur Radio Society (FARS). A part of the International Sister Cities program, FARS has forged a strong link between hams in Portland, Oregon; Tokyo, Japan; Victoria, British Columbia; and Khabarovsk. Every two years since, FARS has held the Friendship Radiosport Games, an international get-together featuring a variety of contests, including a 2 meter foxhunt.

The most recent Games were held last year in Khabarovsk. Kevin Hunt WA7VTD was one of USA's Team Captains. "This was the best trip ever," he told me. "They pulled out all the stops. The games took only four days but we were there for two weeks. We took a side trip to Vladivostok on the Transylvania railroad, went fishing on islands on the Amur river, had parties, dined on caviar, fresh fish and delectable home-grown vegetables. The government underwrote a large portion of the costs of hosting the games. We were welcomed by the Vice-Governor of the Territory."

Others from the Portland area who traveled to Russia for the 1995 Games were Rene Berblinger KX7Z, Dick Fredrickson WAØDIM, Dan Early WA6IRO, Steve Ewing KB7MFO, Dale Mosby N7PEX, and Mary Jo Mosby KB7NJE.

ARDF is a regular ham radio activity in many parts of Russia and is the most popular use of the 2 meter band there. One member of the Russian team teaches foxhunting in his country's schools. Therefore, it was no surprise that the foxhunt course was difficult and the Russians were

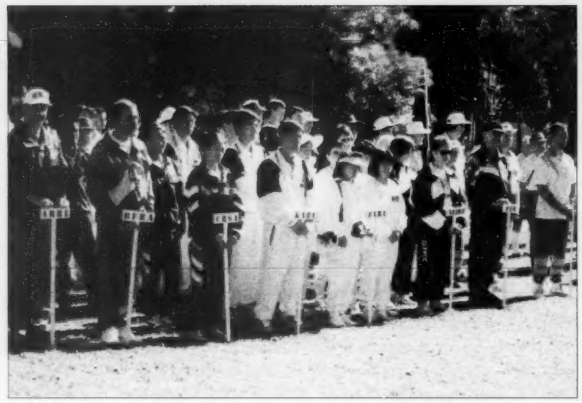

***Photo B.** For the official Region III Championships photo (Queensland, Australia), the competitors stood behind their societies' markers. At left is Kevin Kelly N6QAB representing the USA. (Photo by Susan Kelly.)*

fierce competitors. Besides the Russians, Kevin and his team were up against two teams of Canadians, who have been practicing hard to improve their foxhunting skills since FRG-93 in Victoria.

According to Canadian team member Perry Creighton VE7WWP, "The exact rules for the Khabarovsk hunt were not announced until the last moment. The competitors were trying to figure them out as they stood on the starting line." As it turned out, rules were quite similar to International Amateur Radio Union (IARU) standards. The minimum age for the Old-Timer category was 42 instead of 40. Instead of a distinctive punch at each fox, there was a concealed official who would mark competitors' cards with a secret initial.

VE7WWP continues, "The foxes were well hidden. The orange markers (prisms) were supposed to be visible within five meters, but in one spot they had the fox buried under a pile of leaves. The official was watching from a tree a ways away recording numbers. Some people spent a half hour looking for that particular fox, then gave up and carried on. That created a bit of consternation.

"I went right up to one strong signal location, walked around it for about 20 minutes and finally got disgusted," WA7VTD told me. "I ended up going overtime and getting disqualified. On the other hand, WAØDIM was cynical and decided that it simply had to be in a big pile of blackberry bushes. He got down on his hands and knees and suddenly he saw a pair of eyes. There was a Russian soldier in camouflage buried under the big pile of brush. Dick stuck his card in there and the guy just smiled and marked it."

The foxhunt site was a large section of thick forest near Camp Dubkii. Total course length was very long, about 10 kilometers, with five fox transmitters. "Athletes found it necessary to DF their way back to the continuously-running finish-line fox," Kevin says, "because tree density on the course rendered map navigation nearly impossible."

The difficult course and well-trained opponents resulted in a bad day for the red, white and blue. Anatoly Kozurov stunned everyone by finding all of his foxes and crossing the finish line in 50 minutes. He narrowly edged out second-place winner Alexander Turkin, who won eight other gold medals in the Games.

One shining star for the USA was 15-year-old Steve Ewing KB7MFO (**Photo A**). "It was amazing!" says WA7VTD. "At the last minute I explained to Steve how to use the Russian RDF gear. He had never done foxhunting or any kind of contesting, but he ended up the second best American foxhunter at the match."

Both Canadian teams did better than the USA teams. "We are very serious about foxhunting," Perry says. "We practice each week in Victoria. I believe we proved that we can run with the Russians in the woods. Our problem was not equipment, it was legs. None of us were under 42, some of us are hitting 60, and one of our guys is 75."

WA7VTD told of some unexpected events during the hunt: "Two contestants surprised amorous

couples in the deep woods. Russian competitor Oleg Stavitsky stumbled across the day-old corpse of a homicide victim. The militia and police graciously allowed the hunt to be completed prior to removing the body. A suspect was arrested the next day."

Many of the USA participants had been to Khabarovsk for the first Games in 1989. "Although prices of goods are more realistic and goods themselves are in greater abundance, the upheaval of the past five years has created many homeless people and organized crime is thriving," Kevin says. "Most Russians earn less than $100 per month and government support of medical care and education is being dismembered. Nonetheless, our enterprising ham colleagues continue to find ways to make ends meet. The hospitality shown to the visiting hams was nothing short of spectacular.

"We were hosted by the families for one week and then put up for one week at a hotel," VE7WWP adds. "It was very enjoyable. I wouldn't have missed it for the world and I have every intention of going back on another visit."

A championship Down Under

The route to a world championship gold medal in radio-orienteering is through the IARU. Member societies sponsor national championships and they collaborate to put on championships at the Region and World levels on a rotating basis.

There are three IARU Regions: I is Europe, Africa and former USSR countries; II is North and South America; III is the rest of Asia and the South Pacific. IARU Region II has no official ARDF activities, sad to say, but contestants from our continent are welcomed as "friendship" category competitors in all IARU sponsored radiosports events.

Avid transmitter tracker Kevin Kelly N6QAB of Lusby, Maryland, has family ties to Australia, so he planned his 1996 vacation there to coincide with the IARU Region III championship in Townsville, on the northeast coast of Queensland. Kevin and I exchanged E-mail with Region II IARU officials and obtained authorization for him to be the official representative of the ARRL (the USA's IARU member society) at the championships (**Photo B**). As a result, Kevin says, "I got the royal treatment."

China is the leading ARDF proponent in Asia. That country has been active in the sport for many years, holds many internal competitions and has excellent radio-athletes. Kevin says Region III Championships Chairman Wally Watkins VK4DO learned about ARDF when he was stationed in China. Since then, Wally has played an important role in bringing it to Australia. China was well represented at Townsville, as well as Korea, Japan, New Zealand, Australia, Poland, Kazakhstan (**Photo C**) and Bulgaria. Also present were observers from Thailand and Malaysia.

The Championships lasted for four days. The first day featured a practice run on the University grounds with just two foxes (**Photo D**). The second day was the 2 meter competition. Then there was a day of rest and ceremony, including a reception with the mayor, followed on day four by the 80 meter competition.

Each competitor provided his or her own RDF gear. There were wide variations among sets from different countries. "The Koreans had different colors of fluorescent paint on their antenna elements," Kevin says. "It looked like they were using some exotic archery gear."

Exact sites were not announced in advance. "For the 2 meter hunt we met in a parking lot," N6QAB reports. "Buses showed up and we had to get on them. Nobody was allowed to drive. The bus took 45 minutes to get to the start point, somewhere near Mt. Louisa. They had it all set up with a covered awning and special places for the gear of each country. Once you left the start you could not come back to it, period. You put all the stuff that you weren't going to take with you in a plastic bag and gave it to them. They carried all of it to the finish point.

"You didn't have to find the foxes in order," Kevin continues. "I came out of the starting corridor and there was one strong signal right in front. The next fox was on the same bearing line, so I figured I'd take two at once. As I went along, it became apparent that the rest of them would be on the return trip.

"I went over a hill, walked a while, scaled another hill, and finally just over the rise I saw a couple of referees. I became intent on watching them, thinking they were watching the fox. Bad assumption! I walked right by it and spent two full five-fox cycles

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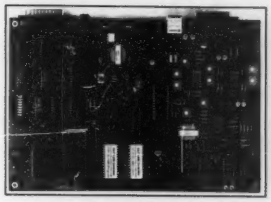

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Photo C. *The Kazakhstan team came from the Higher Radio Engineering and Radio Sports School. At left is UN7JR, the foxhunting teacher. (Photo by N6QAB.)*

looking where I was probably within kicking distance. In heavy brush, that red flag doesn't mean squat unless you're right on top of it.

"At the next fox, the judges were hiding, but I saw a purple bag about a hundred yards away from me. I thought, 'That's not naturally occurring.' Sure enough, about 10 feet from that was the prism. As I went to it, they popped up from a crevice about 10 feet from me and waved.

"For the next transmitter, I had to go cross-country, away from the trails. All of a sudden there was a little shack with all kinds of stuff around it. Some guy was sitting out in his yard looking like a prospector. I could see where he had been doing some shooting. But there was no fox there.

"This was a lot longer course than any other foxhunt I had been on, even though I was taking the right route. A signal would be really strong and I kept thinking I was close and then there would be another hill to go over. I kept saying to myself, 'Hey, I'm in the Old-Timer category,' and I was liking it because I only had to find four of the five transmitters.

"I was being very careful not to go over the two-hour limit and disqualify, but I exerted so much that I started getting cramps in my legs. This never happened before. I had really good bearing on the fourth fox, I think it was on top of this really big hill, but I had only 20 minutes left so I gave up and headed for the finish line."

As **Table 1** shows, the Chinese were the big winners. Even though N6QAB didn't find all his foxes, he fared better than some contestants. "One of the New Zealand guys broke his ankle in three places," Kevin reported. "He was really laid out, but he still had his sense of humor. A Japanese hunter fell and hit his head. He came running through the finish line with a big red headband. After I made some comment about it, he took it off and there was blood all over."

There was plenty of non-radio fun at the Championships, too. Delegates visited the Billabong wildlife sanctuary, mountain biked and rode scooters on islands and beaches. "Almost every competitor was a licensed ham," Kevin says. "A lot of them didn't speak English, but English was the official language. The headmaster from Kazakhstan spoke excellent English. One fellow from Poland spoke Russian and interpreted a lot for me."

Future opportunities

The two Kevins and all the others who have taken part in multinational radio-orienteering competitions know that these events are unmatched for enhancing ham-to-ham international goodwill. There are plenty of upcoming opportunities for you to get involved in the sport. The next IARU World ARDF Championships are scheduled for Bavaria, Germany, in September 1997. If you are interested in attending as an observer or participant from North America, contact me and I'll try to help get your credentials.

FARS-Tokyo will host the next Friendship Games in 1997. The organizers will host 10 participants from USA and 10 from Canada; all others may participate unofficially. FARS chapters in USA and Canada are planning a North American Open Foxhunt to select members of the respective teams for the Tokyo meet. To find out more about this and other FARS activities, write to FARS, PO Box 13344, Portland OR 97213. FARS may also be reached via packet radio: KC7LRM@W7KYC.ORUSA.NOAM. Canadian foxhunters should contact FARS-Victoria via Perry Creighton VE7WWP, 4011 Hollyridge Place, Victoria BC Canada V8N 5Z8, or send E-mail to fars@bc.sympatico.ca.

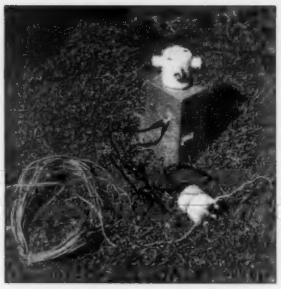

Photo D. *The Australians built unique dual-band foxes for the Championships. An 80 meter wire antenna is shown here. For 2 meters, the wires are disconnected and four horizontal whips are mounted to the insulator atop the box. (Photo by N6QAB.)*

I hope your club is planning its own international-rules foxhunts to promote the sport and give members a chance to practice and learn the skills. See the two-part "Homing In" series in the August and September 1996 issues for details on how to put on such events. Also check the "Homing In" web site (http://members.aol.com/homingin/) for more help, plus the latest news of upcoming ARDF events and links to ARDF sites in Europe and Asia. Let me know about meets in your area well in advance, so I can help spread the word. Send E-mail to Homingin@aol.com or postal mail to the address at the beginning of this article. 73

Category	T's	Best Time	First Place	Second Place	Third Place	Team Champs
2m Seniors	5	50:06	China	China	China	China
2m Juniors	4	49.31	Korea	Japan	Korea	Korea
2m Women	4	52:44	China	China	Japan	China
2m Old-Timers	4	69:03	Bulgaria	Japan	Japan	Japan
80m Seniors	5	40:22	China	China	China	China
80m Juniors	4	68:00	Korea	Korea	Korea	Korea
80m Women	4	48:18	China	China	Japan	China
80m Old-Timers	4	58:36	Korea	Japan	Bulgaria	Korea

Table 1. *Medal winners at the IARU Region III Foxhunting Championships in Townsville, Australia.*

HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108

It's the December issue already, and probably the right time to turn most of our concentration toward warm indoor activities, at least here in the frozen Northland!

Net nite adventures!

From William Thim N1QVQ: "This idea may not be totally new, but bears repeating just in case some may not have heard of it... it concerns some operational suggestions for 'Emergency Practice Nets.'

"When the net control station feels that his or her net members are ready, try not starting the net on time and see what happens! You should have a back-up net control station. How long will it take your backup to jump in and assume control of the net? On a different occasion, prearrange with your backup to also not take over then see how long it takes for one of the participants to assume the reins. These 'readiness' tests may seem a bit deceitful at first, but they are good hallmarks of the net's ability to 'run itself,' as it well might have to during an actual emergency.

"We all get used to having things happen in a comfortable, familiar way, but that's not always to be expected in a true emergency situation, because an emergency—by its very definition—is itself unpredictable.

"Here's another test: Try telling all of the check-ins that your emergency battery power is failing, to please recheck-in again five minutes from now, and then see how many actually do. During actual emergencies, you may not have time to fully explain a situation and the net members will have to comprehend something unusual quickly, and follow your suggestions without any further guidance.

"Still another good test would be to tell everyone that they've just lost their normal antenna setup and to check in as soon as they can on their back-up antenna—however simple that might be. Perhaps some stations will have to relay for others who can't be heard by net control; how well is this handled?

"Finally, and this test applies to VHF/UHF repeater emergency nets, announce that the repeater will be turned off, simulating a loss of power at the repeater site. Again, stations will have to be ready to relay for each other and be able to copy weak and noisy signals from around the normal net area, proving that in actual emergencies copy may not always be 'armchair-clear' during times of distress. How well does this work?

"There are probably many more test-worthy scenarios that could be explored by inventive emergency net control ops and members alike, that will add realism and adventure to what might otherwise be routine net nights... while also providing a truer yardstick of how well your emergency net really is trained in its own emergency preparedness."

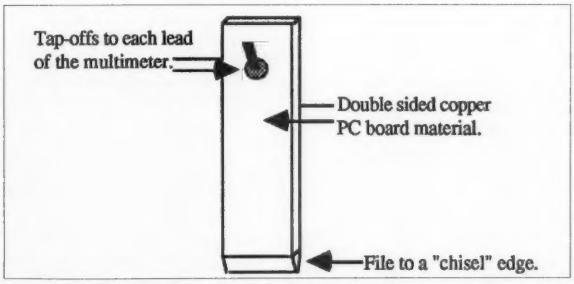

Fig. 1. *K9KPM's "Battery Paddle." The paddle is made of double-sided circuit board material for inserting between two cells in a spring-loaded pack to measure the total current being drawn from the battery pack. See text for details.*

Paddle your batteries

From Ken Guge K9KPM: "Have you ever wanted to measure the current drain from a particular piece of ham gear, or perhaps your daughter's portable tape player that's driving you close to the poverty level with AA batteries? I often thought that battery manufacturers ought to give these things away just to keep you in the high-volume battery-purchasing market. Well here's an easy way to put a milliammeter in series with those cells, without having to cut into the circuitry itself.

"Take a piece of scrap double-sided printed circuit board material (about 1/2" wide by 1-1/2" tall, and solder a short length of stiff wire on each side of the double-foil-sided board. These will be the 'quick' connection points for your VOM. Next, on the opposite end, file the 1/2" side down to a 'chisel shape' so that it will slip easily between two of the series connected cells in the spring-loaded holder (see **Fig. 1**). Now, when you insert this 'Battery Paddle' into the pack, you'll interrupt the current flow, but then hooking up your milliammeter will restore the flow and give you an accurate estimate of how much the little battery-eater is drawing.

"You can use this as a troubleshooting aid and know right away when you've cleared a high-current-drain problem or use it simply to check the battery drain for the sake of curiosity.

"If you make two of these paddles, you can insert one at each end of the series battery circuit, so that you can hook up a charger to the 'cell-side' of each paddle (being careful to observe the correct polarity), if you've decided to stop buying throwaway cells and use rechargeables instead.

"If you hook up a test power supply to the 'equipment-side' of each paddle (again, observing correct polarity) you can power the item from that external supply, instead of from the internal battery cells, for those times when it might receive extended use.

"I hope that this idea proves as useful to others as it has for me."

Moderator's note: Good tip, Ken. By the way, here are some typical milliamp-hour figures for alkaline-manganese dioxide cells, directly from Duracell®:

AAA—1,120 mAh
AA—2,450 mAh
C—7,000 mAh
D—14,250 mAh
9V—565 mAh

Below are some typical mAh capacity figures for 9 volt batteries at different current drains:

600 mAh @ 5 mA drain
560 mAh @ 14 mA drain
546 mAh @ 26 mA drain

You can see that the mAh figures will vary a bit depending upon the actual current drain, higher current drain giving less amp-hour life, but they're still a good guidepost for general usage. When you measure the current drawn by a particular piece of equipment, using Ken's battery paddle idea, divide that figure into the total capacity shown above for the size of cells you're using to get an approximate idea of the number of hours of use to be expected from those cells.

"You can drag out the shovel and split open the ground, but why not let nature do some of the work for you instead?"

No-drip 9913

From Chuck Steer WA3IAC: "Belden 9913® coax cable and its clones have been known to change from a nice dry transmission line into a water pipe after repeated soaking rains, compliments of Mother Nature. This can be the combined result of the cable itself having an internal 'air' dielectric, coupled with a non-watertight fit between the cable and its outdoor connector.

"I've solved the problem at my QTH by always using a length of 3/4"-diameter heat-shrink tubing over the finished connector's back end, then wrapping the entire connection with Teflon® self-adhering tape. If you don't have a heat-shrink gun, you can always 'borrow' the XYL's stove for a few minutes to acquire the heat needed to make the shrink tubing good and tight over the rear of the cable/connector interface junction. Don't depend upon overlapping tape alone to seal this critical point."

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Watts In	*1*	*2*	*3*	*4*	*5*	*6*	*7*

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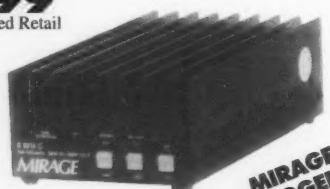

MIRAGE RUGGED!

Power Curve -- typical B-5016-G output power								
Watts Out	*130*	*135*	*140*	*145*	*150*	*155*	*160*	*165*
Watts In	*20*	*25*	*30*	*35*	*40*	*45*	*50*	*55*

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Moderator's note: Chuck has a couple of good suggestions here. For the heat-shrink-tubing part, I've also had excellent results with the type of heat guns generally sold in hardware stores or home improvement centers—intended for use in stripping paint or for thawing frozen pipes. There's the large "gun" style and also a smaller "point-source" style (my personal favorite) that will handle most jobs around the electronics workbench. They're usually quite a bit less expensive than heat guns sold specifically for heat-shrink-tubing applications alone, so if it's dropped, the loss isn't as great. I use one of the small "point-source" heat guns for applying concentrated heat to a circuit part that I suspect of being overly heat-sensitive, and in general troubleshooting as well.

Recycling is "in"!

73 reader **Andrew Gretchenuk** sent in this innovative idea, along with the samples shown in **Photo A:** "Whenever I go to a garage sale, house sale or flea market, I keep an eye peeled for any enclosures that might have ham radio or electronics applications. One of the ones that I particularly watch for is normally used in the kitchen, and consists of three or four wooden canisters of the style that 'nest' inside of one another for storage. They often make great little speaker enclosures or general radio project housings (for receivers, meters, test gear, etc.). To adapt them to a project, I'll usually use the scheme shown in **Fig. 2** to give me a metal 'partial chassis' for parts mounting. The spacers shown in **Fig. 2** can often be picked up at hamfests, or you can obtain them from parts suppliers such as Fair Radio Sales of Lima, Ohio (Tel. 419-227-6573) or

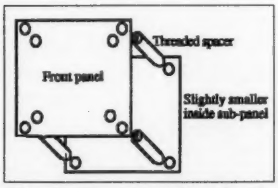

***Fig. 2.** Front panel and sub-panel (chassis) for use with a recycled kitchen storage box. See Andrew Gretchenuk's suggestion in the text for complete details.*

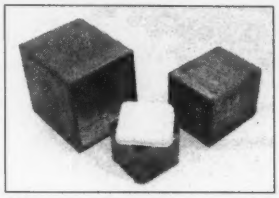

***Photo A.** The nested wooden kitchen canisters described by Andrew Gretchenuk are shown on the left and right sides of the photo. The repainted candy tin is in the center, painted "ham gray," of course!*

The Electronic Goldmine in Scottsdale, Arizona (Tel. 1-800-445-0697). They can be obtained in various lengths from 1/4" on up.

"Another item to watch for at secondhand sales are metal cookie or candy tins. When repainted with metallic automobile spray paint, they often end up looking very professional and make excellent shielded enclosures (also shown in **Photo A**). Most are even directly solderable when buffed up a bit and soldering paste is applied."

Moderator's note: All good suggestions, Andrew, and thanks for sending the samples for photographing. Another source of handy very small "recycled" cases are those used to package Tic-Tac® breath mints; they'll hold a miniature remote toggle switch, a few small parts, or will act as a cable splice junction box. Either leave them transparent or apply a quick spray of your favorite color of "ham gray." It's best to put the mints inside of something else that doesn't make so much noise in your pocket anyway!

Pinned to the mat!

From Herb Foster AD4UA: "When the need arises to 'hide' radial wires or a small coax feed cable for an HF 1/4-wave vertical out on your lawn, here's a tip to keep in mind, one that I've used myself very successfully. Of course, you can drag out the shovel and split open the ground wide enough to accommodate those radial wires or RG-8X coax, but why not let nature do some of the work for you instead?

"Gather up a handful of wire coat hangers, the ones that seem to accumulate in closets as if they're breeding there! (I can't recall ever paying for a wire hanger... my XYL always seems to be able to produce a nice bunch for me upon request.) Once in

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hand, use a sturdy cutter to clip off the hanger's normal 'hook' and straighten out the remaining length. Next, cut this straightened piece into 9" or 10" lengths and form a 90-degree (or more) bend—about an inch or so from one end—in each of these smaller lengths. Make up a bunch of these 'cable pins,' and push one down into the earth about every 15" or so along the radial or transmission line run. The 1" bend will 'pin' the wire closely to the ground and keep it there. If you've mowed the lawn somewhat on the 'short side' first, so much the better; the grass will grow up around the 'pinned-down' wire and your radials and transmission line will eventually almost disappear into the lushness of the turf. If done correctly, you'll be able to mow right over the radials and coax as if it weren't even there. This tip works equally as well at your home QTH as it does at a temporary 'ham-cation' spot!"

A better cube!

From Stephen Reynolds NØPOU: "Most of the inexpensive wall-mount plug-in DC power "cubes" that are available today have no internal regulation and will often sag to close to 50% of their labeled voltage when loaded to near their labeled current rating. Some items of equipment (if they have their own internal regulation) will work correctly when powered by these 'cubes,' but other items won't. Applying too much or too little voltage to certain accessories can be risky at best but here's a way around that potential (ouch!) problem!

"DC-to-DC automobile cigarette lighter adapters can be found that will lower and regulate the normal 12 volt DC car battery potential down to some other (often selectable) value... and these little gems can also be used on the 120 volt power 'cubes' mentioned above. Just be absolutely sure that you observe the correct input and output polarities, and that the current drain expected doesn't exceed the rating on either the power 'cube' or its DC-to-DC regulator add-on. Take a look at the Radio Shack™ catalog if you haven't seen the DC-to-DC adapters I'm referring to; the catalog shows several that are applicable."

Moderator's note: You might also consider building up a small external regulator using one of the many fixed voltage regulator chips on the market today. They're available in several size and current ratings and are extremely easy to put to use. The 78xx family of 1 amp positive voltage regulators in a TO-220 case (as shown in the drawing of ***Fig. 3****) can be commonly found in these standard fixed output values:*

7805T—5 volts
7806T—6 volts
7808T—8 volts
7812T—12 volts
7815T—15 volts
7818T—18 volts
7824T—24 volts

You can also incorporate an adjustable regulator, such as the LM-317T, shown in last month's column.

Fabulous ferrite

From Jim Kocsis WA9PYH: "Have you ever noticed how generally poor the AM sensitivity is on most of today's small portable transistor broadcast band radios? The sensitivity on the FM band is usually much better because this band uses either a telescoping whip antenna, or perhaps a fairly long headphone cord, allowing the capture of a reasonable amount of usable signal... but the AM band is a whole other story.

"The sensitivity on AM is limited by the effectiveness of the built-in ferrite rod antenna used for AM band pick-up. As the size of the radios has been shrinking, so has the ferrite rod's length—often ending up to being only a couple of inches long. I have a "super" AM radio that contains an 8"-long ferrite rod antenna, and it runs rings around the smaller radios... primarily because of the longer rod.

"Not wanting to have to carry the larger radio around, I decided to experiment a bit. I tried positioning just a ferrite rod, about 8" long, at various points around my little radio's case and found that reception could be markedly improved. You can find these larger ferrite rods at hamfests, garage sales or flea markets (the salvaged parts of older AM radios or perhaps the entire defunct radio itself). Simply strip off the coils of wire, then find the best spot on the outside of your small AM portable—where the signal is enhanced significantly—and using a rubber band to hold the 'auxiliary signal booster' in place, get ready for greatly improved performance. The flat ferrite form will give you the lowest profile, of course, but the round rods work well too. Be careful handling the ferrite material, it's very brittle and will easily snap if dropped or mishandled. Give the idea a try, it might just make you the 'hero of the day' to your wife or children (grandchildren?)."

This ends another month of "Ham To Ham." From KA9UCK (Sue) and me, all the best of the Holiday Season's joys and happiness. I hope that Santa brings you some interesting ham radio toys... remember, gals, men like toys as gifts, not clothes! We're actually just little boys in bigger jeans!

And now that winter has set in to stay for a while, why not sit down and write a brief description of some of the things that you've found useful in the pursuit of your own ham radio interests? I'll share them with the other *73* readers through this column in the coming months. Items of interest for spring and summer projects would also be appropriate to send in now... magazine lead times are fairly long. Please send all tips, suggestions, ideas and shortcuts to the address at the top of this column. See you next year! 73 de Dave NZ9E.

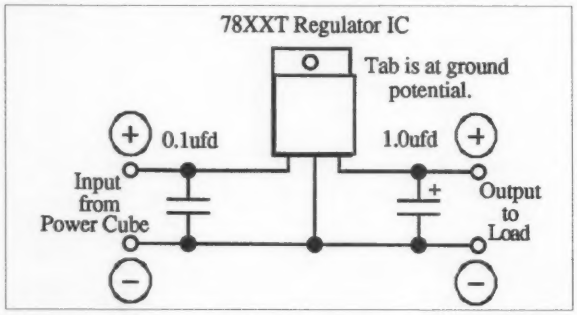

Fig. 3. *A 78XXT series regulator chip can also be used to stabilize the power output from an inexpensive DC wall power cube. See the "Moderator's note" with NØPOU's tip for further details.*

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NEVER SAY DIE

Continued from page 49

looking forward to it. Most report coming into contact with a supreme being that radiates love. Most are told they have tasks to do on earth before going to "heaven" and so must return until it is their time. While most of them become more religious, few continue going to organized religion churches. They come back with the message that God isn't interested in theology. Most of them, while dead, undergo a life review where they experience what they felt and what the other people around them felt as a result of their actions. I have an ex-wife who's going to have a major problem with that, and not a few ex-employees.

Of course I can't help, while reading about these NDEs, looking back at my life to see how I might have done better. My total lack of interest in money has been a hardship for my wife, who is much more money-oriented. It's also been a magnet for those who would take advantage of my lack of interest and who have robbed me of millions. But, having (at least in my eyes) helped the world along with the development of cellular telephones, microcomputers, compact discs (better music), my record companies, and now (hopefully) with cold fusion, I feel my visit to earth has been worthwhile.

My love of amateur radio has been guiding me for most of my life. Sure, I get frustrated when I hear hams using bad language and being inconsiderate on the air. I almost got angry when the ARRL virtually destroyed the hobby 30 years ago in their move to generate greater visibility for the League with their so-called "incentive licensing." And my ability to forgive, forget, and love my enemies is sorely strained when people print lies and distortions about me. Shame on you, Fred.

Another, slightly older, book on NDEs is Dr. Moody's *The Light Beyond* (1988; $4.50; 205p). He even interviewed a number of children who'd had NDEs, with their stories all being quite consistent.

The reports are that a whole realm of the afterlife is set aside for the pursuit of knowledge. Well, I've got a good start in that direction. When I die it's going to take a trailer truck to bring my library... and I'm not going anywhere permanent without it. If I can't take my books and CD collection, I'm not going.

Closer To The Light by Dr. Morse (1990; $6; 237p) deals with children's NDEs. What does it feel like for them when they die? What do they learn? We're going to have to understand more about how time works because many NDE reports have to do with future events. You'll also enjoy Brad Steiger's *One With The Light* (1994; $5; 300p), which not only covers a wide variety of NDE reports, but shows how in every case the experience has substantially changed the people's lives.

If you've read very many biographies you know that many (most?) of our creative artists attribute much of their inspiration to the ineffable. Sousa said that all of his marches came to him when he was in a half-sleep state. They came full-blown, so all he had to do was get up and write them down. Many composers and writers tell similar stories. In *Neither Dead Nor Sleeping*, May Sewall (Bobbs-Merrill, 1920; 320p; $2.50 in an old bookstore) wrote that her deceased husband explained to her that spirits on "the other side" are responsible for these subconscious creative events.

There's a current spate of books about guardian angels. The recent TV programs on angels probably triggered this interest. In between reading Peter Graneau's *Ampere-Neumann Electrodynamics of Metals* I'll whip through Hope Price's *Angels*, a $5 Avon inspirational paperback which reports on hundreds of angel interventions. There are a bunch more angel books, all packed with stories of people who've been touched by them. Now, are you going to try and tell me that every single one of these people is totally mistaken? Give me a break!

No, I can't see auras or bend spoons, but I have no good reason to disbelieve the many people I know who claim to have done these things. There are a great many things going on that we have no good scientific explanation for. Can you assure me that not one person in history has ever been able to dowse? My grandfather, who was an inventor, taught me how to dowse. "Pop" was good at it. He also was a good inventor. You wouldn't see Citgo or Continental Can Company around today except for him. He knew a lot about everything, so I accepted dowsing and had no trouble learning how to do it when I was about seven. Alas, he was a heavy smoker, so he died when I was only 12. My grandmother, who didn't smoke, lived on almost 30 years longer. I'll have to tell you more about her sometime. She put me onto the Sewall book three years after she died.

Though I haven't had a near death experience, I still have a pretty good idea of what my mission in this life is. It's what I've been doing for the last 44 years as a publisher: sharing the things I've found fun and exciting with as many people as possible, and urging you to share what you've learned with me. So I'm on your case, urging you to do better. To lose weight and thus live a longer and happier life. To not smoke. And to be adventurous. To try new things. Go new places. Try packet. Try satellite communications. Try going on a DXpedition somewhere. Learn more. Read.

If your reaction is negative, remember that this could be an approach to life that you carry around with you. Life is more what you make it than a box of chocolates. If you're nasty, so will be the people around you. If you get on the air to have fun and meet new people, that's what you'll find, for the most part. When you run into an ill-mannered op try another frequency instead of getting mad or getting even.

One thing both the angel and the NDE reports all agree on is that prayer can be surprisingly powerful. It doesn't seem to matter what deities you believe in, just the act of praying has power to heal and change things. No, this is not a new concept and it doesn't mean that poor old aging Wayne is newly converted to any particular savior. I'm just telling you what thousands of people I've read about have reported.

As I'm writing this I'm thoroughly enjoying a CD of Louis Moreau Gottschalk's (1829-1869) music. His music was sort of a precursor of ragtime and he was the first internationally famous American composer. Though it's difficult for me to imagine, I suppose there are some people who might not find his music irresistible. His Tarantella, Résponds Moi, Ojos Criollos, Orfa, La Gallina, Bamboula, Grand Fantasia, and Pasquinade are incredible. If I can't get you to enjoy reading books and learning, maybe I can turn you on to some wonderful music. No, all you want me to write about is ham radio, right?

So what do you find the most exciting about amateur radio? What adventures have you had? If you've made even a hundredth the number of friends via the hobby that I have, it's paid off handsomely for you. That's probably what brings me back to Dayton almost every year. When's the last time you had a contact where you talked with someone for over an hour and you both hated to end it? I used to offer a certificate for long-winded contacts, the Real Rag Chewer's Club certificate (RRCC) for contacts over an hour. Let me know if I should offer that again.

Of course I used to offer a WAAS certificate for hams who'd worked 49 states. Worked Almost All States. Then there was my CHC Certificate Hater's Club for hams who hate certificates and promise not to go after them, and if they do, by chance get one, they promise to hate it.

Maybe it's best I don't write about amateur radio and just stick to my secret goals of trying to get you to have more fun, to learn, and shape up.

Grist

With several hundred of the Art Bell listeners sending for a book of my not-yet-published *73* editorials, I started rummaging through the back issues, pulling out my non-ham oriented comments and putting them together into books of about 50 editorials each. *Grist I* and *Grist II*. If you enjoy my stuff you might send for a few copies of these for any friends you have who might enjoy thinking. Yes, I expect this is pretty restrictive. When I think over most of my friends, hams or not, darned few of them seem to be much interested in thinking.

Maybe that's why, when I get someone on the phone or over the air who's obviously done some thinking and the homework to back it up, we can talk for hours. Golly, that's fun!

Anyway, Professor Green has been reading and thinking, and putting his reports into these editorials. I think you'll enjoy the

Continued on page 63

HAMS WITH CLASS

Carole Perry WB2MGP
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Some Hands-On Fun

With the start of a new school year, most teachers and instructors of ham radio classes are looking for new activities and demonstrations to do in the classroom. Experience shows that hands-on demos and experiments are the most fun and therefore the most memorable to the children. This term I tried something new.

I allowed one of my classes to pick their own hands-on activity to demonstrate to each other. Each group consisted of four team members. They had two weeks to prepare a demo to present to the class. They had to research the activity and come up with an interesting presentation about the unit we were studying, which was about batteries.

Obviously, the criteria for setting up the groups and for the complexity of the project will be determined by the age and ability of the group. But the sixth-graders I did this with really seemed to love the idea of coming up with their own project. I gave them time to spend in our class research center and for "putting their heads together." They were off and running to local libraries as well.

The charts and diagrams that were submitted were simply excellent. Here are two of the eight activities that were very well received by the children.

How do batteries work?

"How Do Batteries Work?" was presented by two boys and two girls in the sixth grade. Justin had big illustrations of the inside of a battery and explained to the class that a dry cell battery consists of a zinc container, a chemical paste, and a carbon rod. A chemical reaction involving these three materials produces electricity. The battery stops working when all the materials dry up inside the battery. In rechargeable batteries the chemical reaction can be reversed.

Photo A. Sixth-grader Mike sets up a circuit with wires and a battery.

For this demonstration you'll need the following items: an LED, two dishes, vinegar, two pieces of zinc (silver coins may work), two pieces of copper (pennies may work) and wires. In this activity, the vinegar acts like the paste inside a battery. Lemons or pickles work as batteries just as well as vinegar. The metals and vinegar react together to produce electricity.

Set up the circuit with a piece of zinc and copper in each dish of vinegar. When the LED didn't glow at first, we connected it to the wires in the other direction, using alligator clips. The kids really had a good time trying the same demonstration with the lemons and pickles. Always remember that being able to have children associate learning with fun is a number one priority in the classroom.

Tanisha did her part by giving a brief background on the "First Batteries." She explained that in 1791 the Italian scientist Galvani noticed that a leg from a dead frog twitched when touched by metal instruments. Electricity was flowing between the metal and the fluids in the leg. This effect was seen by another scientist, Volta, who went on to invent the first battery. He used stacks of zinc and copper disks, separated by fabric soaked in saltwater.

Sockets and switches

The second demonstration had lots of illustrations to go along with it. Making clear and informative charts is a whole unit by itself with the sixth grade. This one was called "Sockets and Switches." Materials needed are: two wires with alligator clips, a bulb (2.5V) and socket, a battery (1.5V) and holder.

Henry reminded the class that electricity can only flow along an unbroken path. The battery pushes electricity all the way around the circuit. The voltage written on a battery tells you how hard the battery will push electricity around a circuit. If you double the number of batteries in a simple circuit, you double the voltage pushing the electricity around.

First the kids screwed the bulb into the socket. Next they put the battery in its holder, then connected the wires to form a circuit. The next step in this interesting demo required an extra wire with alligator clips, tape, foil, and a thick piece of cardboard. They proceeded to add the extra wire into the circuit. Then they made a switch by taping pieces of foil to the cardboard so that they overlapped. Next they connected the foil to the circuit with the free alligator clips. They could then make the bulb flash by touching the pieces of foil together.

Take a guess what this demonstration was the introduction to in my ham radio class. In my next column I'll report on some very simple hands-on telegraph keys. If you are a teacher who has done some exciting activities with ham radio classes, please send me the details along with the children's pictures so that we can share it with other instructors. 73

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Continued from page 61

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The concepts of spread-spectrum date back some 50 years, and maybe more, but until recently the circuitry required to use it was so expensive that only the military found it feasible. In the last few years, however, spread-spectrum equipment has become quite common in many areas.

Consider the following example: Suppose your name is Kilroy, you were supposed to meet a friend in some room, and you want to leave him a message that you've come and gone. The problem is that you have an enemy, and you don't want her to know you've been there.

You could scribble "Kilroy was here" on the wall, but that's too obvious. (Besides, graffiti is ugly!) So you decide to leave a little note that reads KILROY WAS HERE. The problem is—where to put it?

You don't want your enemy to know that you left a message. Even if she knows, you don't want her to find and read it. Worse yet, your enemy might remove it, or perhaps change it to read KILROY WILL BE HERE. Or someone completely new might come into the room, need a piece of paper to write on, and scribble all over your note.

This is a problem that is faced by the military. When sending an important message:

(a) You don't want the enemy to know about it;

(b) If he knows about it, you don't want him to be able to read it;

(c) If he can read it, you don't want him to change it into something quite different; and

(d) You don't want a transmission from your enemy, or even someone else, to interfere with your message and prevent it from getting through.

So back to the room. You spot a telephone directory lying on the table, so you write your KILROY WAS HERE message into it. You put the K on page 55, the I on page 113, the L on page 38, and so on. In other words, you spread your message throughout the directory, hiding it amid the printing that's already there.

"How should you pick the page numbers on which to write?"

In order to find your message, someone would have to know exactly where to look for it. Your enemy won't know that; in fact, she may not even notice the extra few letters written in amongst the "noise" of all the other stuff in the telephone directory. But even if she notices the extra printing, she won't know the order to put the letters back into. (Obviously, though, you'd better tell your friend where to look!)

Now suppose someone else comes into the room and decides to leave another message in the phone book. This new person is very unlikely to pick the exact same pages that you did, so the new message will probably not interfere with yours. Even if, by some chance, a few of the page numbers he chose happened to be the same ones you already used, at most he might overwrite one or two of your letters. Your message might now read KILXOY WAR HERE, but that's still enough to get the message through—better than putting your entire message in one place and taking a chance on its all being obliterated.

This silly little example is actually quite useful in answering some basic questions. For example, how should you pick the page numbers on which to write? There are several ways:

(a) Roll some dice to get completely random page numbers. Nice, because that makes it really tough for someone else to figure out the sequence. It also helps to spread the message throughout the entire phone book. But now you will have to give the list of page numbers to your friend. These numbers would be random if there is no pattern to them—even knowing all the past numbers that were used, you can't predict the next few numbers.

(b) Build two sets of loaded dice—one for you, one for your friend—set up so they both roll the same numbers. You roll your dice to get a set of page numbers. Later, your friend rolls his set of dice in exactly the same way, gets the same numbers and bingo. These page numbers look random, but actually they are not—if you have the loaded dice (or know how they were built), you can duplicate the set of numbers at any time. Such a set of numbers is called *pseudo-random*.

(c) Come up with some other way of generating pseudo-random numbers. For example, there are digital circuits that can generate long strings of digits that

look random, but are not. Or there are math formulas that can do it. As long as you and your friend both have the same circuit or formula, you can duplicate the same sequence of page numbers.

(d) If you need to do this every day, should you reuse the same numbers each day, or should you start over with a different set? If your main aim is secrecy, then you should use a different set each day. But if you're just concerned with keeping down interference from or to other people, then reusing the same numbers every time can be enough.

Now let's see how this applies to radio signals. The traditional idea is to transmit a radio signal on a carrier with a fixed frequency, and to try to limit the bandwidth as much as possible to avoid interference to (and from) others. But a radio signal like this is easy to find (especially with a spectrum analyzer), and easy to interfere with or jam.

Spread-spectrum radio, on the other hand, takes that signal, spreads it over a very large band of frequencies, and does it in a way that looks quite random and unpredictable (but is not!) It is the very opposite of what communicators have been trying to do since the beginnings of radio.

Spreading a signal out over a large band of frequencies also has the effect of bringing it down into the noise. Consider a glass of water. If the glass has a diameter of, say, two inches, then it might be perhaps four inches tall. Pour the same amount of water into a glass four inches in diameter, and the water is now only one inch deep. Pour it on the basement floor and it spreads out over a large area, but becomes only a tiny fraction of an inch deep. In the same way, a 10-watt RF signal all on one frequency stands out like a sore thumb. Spread it out over a few megahertz, and the amount of power at any one frequency is so small that it's almost impossible to measure. It blends into the noise.

There are several different ways to spread the signal over a large bandwidth; the two most common are frequency hopping and direct sequence.

Frequency hopping

Frequency hopping is just what the name says—rather than continuously transmitting on one frequency, the transmitter is constantly hopping from one frequency to another. This can easily be achieved by using a pseudo-random number generator to drive a phase-locked loop. Both the transmitter and receiver must use the same number generator to make sure that each time the transmitter hops to a new frequency, the receiver will go there too.

Your signal actually uses a lot of bandwidth—it spreads out over a large spectrum—but any particular part of that spectrum is used only a bit. Not only is it hard to find such a signal, but it generates relatively little interference to others because it never stays on any one frequency long enough to really bother anyone. It also *picks up* little interference from others: If there is some other interfering transmitter on a particular frequency, your receiver will be on that frequency only a short time, probably not long enough to bother you or him. (And some frequency-hopping systems actually avoid frequencies that are in use by other systems.)

Frequency hopping can be used to send an analog voice signal, but during the times that the transmitter and receiver are hopping from one frequency to another, there would be short breaks or glitches in the signal which would be very annoying. So a more common approach is to use a *codec*—a coder/decoder which does an analog-to-digital conversion to change the analog voice signal to digital data—and then send the digital data in short but rapid bursts. Between the bursts the transmitter shuts off, switches to the new frequency, turns on, and then sends the next burst of data. The receiver collects the bursts of data, slows them down and converts them into a continuous stream of data which, when converted back to sound with another codec, results in continuous speech.

This method has one other advantage: Once the sound is in digital form, error correction can be used to correct for missing or wrong bits of data. In this way, even if two transmitters occasionally hop on the same frequency and interfere with each other, the error correction removes the resulting errors.

Direct sequence

Direct sequence spread-spectrum is completely different from frequency hopping. Let's go back to our analogy of hiding messages in a telephone directory. As we described it, each successive letter of the message KILROY WAS HERE went on a different page. This matches frequency hopping quite well, where each successive part of a signal is sent on a different frequency.

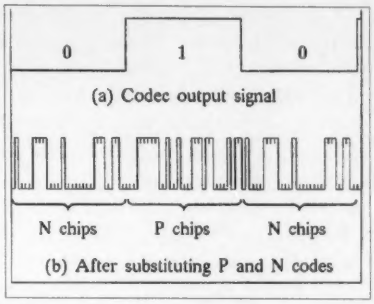

Fig. 1. *Spread-spectrum chips.*

Direct sequence spread-spectrum (DS-SS) is not like that. Imagine that the telephone directory has 100 pages. Take K, the first letter of the message, break it up into 100 pieces, and put a little piece of it on every page of the book. Then do the same for every other letter of the message. At the end, every page of the directory has a tiny bit of every letter. In a sense, your KILROY WAS HERE message is smeared all over the book! That's direct sequence!

Let's use a spread-spectrum cordless phone as an example. Suppose you want to transmit a telephone-quality voice signal having a bandwidth of perhaps 3000 or 4000 Hz, between the handset and the base of the phone. With ordinary AM or FM, it could be sent in a radio signal with a bandwidth as narrow as 6 or 8 kHz (and even less with single-sideband.) With DS-SS, the process is a lot more complicated. We start by converting the voice signal into a digital signal with a codec. This typically gives us 64k bits per second of digital data.

DETOUR

A quick review: For resistors, a k is 1,000 ohms. For computer folk, however, a k is 1,024, so 64k would normally be 64 x 1,024 or 65,536, not 64,000. In this case, however, the number really is 64,000 bits per second, obtained by multiplying 8,000 measurements per second times 8 bits per measurement.

END OF DETOUR

If we ignored the fact that the 64k bps output of the codec has sharp edges (and therefore harmonics) and tried to modulate this onto a carrier the pre-spread-spectrum way, we would have a total bandwidth of 64 kHz.

Direct sequence spread-spectrum takes an extra step, however, before it modulates the carrier. It takes each bit of the data coming out of the codec and replaces it with a whole batch of new bits. In a typical spread-spectrum cordless phone, for example, each bit of the codec output is replaced by 32 bits. These bits break up each codec bit into 32 pieces called "chips." One set of 32 chips, called the *N code*, replaces each 0, while another set, called the *P code*, replaces each 1 in the codec output. In **Fig. 1 (a)**, we see the signal as it might come out of the codec. In **Fig. 1 (b)** we see what happens when the N code replaces the two 0 bits, and the P code replaces the 1. (In this figure, the N code for the two zeroes is the same; for greater security, more complex systems might change the P and N codes from bit to bit.)

"This can easily be achieved by using a pseudo-random number generator to drive a phase-locked loop."

Obviously, the resulting signal has much higher frequency components; in general, replacing the original bits with their P and N codes increases the frequency range by a factor of 32, which increases the bandwidth by a factor of 32 as well. In this case, the bandwidth goes from 64 kHz to over 2 MHz, much more than before. But this means that the transmitted power is spread out over a much wider bandwidth—sort of like spilling a glass of water on the floor. The same amount of power (or water) is still there, but by spreading it over a larger area the depth at any spot is very small. In some cases, the power may be so small that it's at or even below the normal noise level.

As you can imagine, a direct sequence spread-spectrum receiver is an interesting device. It starts off with a fairly normal superhet design, except that the bandwidth has to be wide—as wide as the signal. All of the interesting work occurs after the detector. Because the transmitted signal is spread out over such a wide bandwidth, the output from the detector (usually a phase-modulation detector) looks very much like noise. It would be almost impossible to recover the desired signal, except for one thing—the receiver knows what the P and N codes are supposed to look like! So it knows what to look for.

The circuit that looks for the P and N codes is called a correlator. *Correlation* is a mathematical term which describes how similar two things are to each other by comparing them, item by item. For example, suppose you toss a coin four times and get tails, heads, heads, and tails; call this THHT. If your friend tosses a coin and also gets THHT, that's a perfect match. You both got tails on the first toss, heads on the second, and so on. But note that this is not the same as THTH. THTH also has two heads and two tails, but they aren't in the same places—the first and second toss were the same, but the third and fourth are different. So only half of the tosses matched.

Now, suppose you toss a coin 100 times, and your friend also tosses 100 times. On the average, you'd expect 50 of your friend's tosses to be the same as yours, and 50 to be different. So if you get somewhere around 50 matches out of the 100, that doesn't show anything special; that's just the way random events happen. We'd say that this is *uncorrelated.*

But if all 100 of your friend's tosses exactly match all 100 of yours, that's suspicious. Sort of like two students who take a true-false test in a subject they know nothing about, and get exactly the same answers (some right, some wrong.) Suspicious, right? I would say that these two sets of answers are correlated—that one student probably copied his answers from the other. That's a correlation of 100% (or just +1.)

But what if the two students get answers that are completely different? Each time one answers TRUE, the other answers FALSE. I'd say that's also suspicious—almost as though one copied from the other, but purposely changed his answers because he decided the other chap was always wrong. In our case, we'd say this is -100% correlation (or just -1.)

So if two signals are very similar, the correlation is close to +1; if they are opposites, the correlation is -1; if they aren't related to each other, the correlation is 0.

Now back to a very simplified explanation of the direct sequence spread-spectrum receiver. The signal coming out of the detector is noisy, but at any instant that noise might be positive or negative. This voltage is sent to a capacitor, which averages that voltage over the length of one chip. At the end of that time, the capacitor voltage may be slightly positive or slightly negative, and the circuit uses that voltage to decide whether that chip seems to be a 0 or a 1. It then sends that chip into a digital circuit which stores it, as well as the 31 previous chips. In other words, this circuit (called a shift register) stores the last 32 chips that have come out of the detector. (The shift register always stores the latest 32 chips; each time a new chip comes out, the oldest chip in the register gets pushed out, so the very last 32 chips are always in the register.)

Now the correlator goes to work. The receiver knows what P and N codes the transmitter is using. So the correlator continuously looks at the 32 bits in the shift register, and compares them bit-by-bit with the 32 bits in the P code and the N code that it knows the transmitter used. Each time it finds a match, it says, "Aha! I got one!" (For those of you mathematically inclined, this process is called *convolution.*)

With 32 bits in a P or N code, there are 2^{32}, or more than four billion possible patterns to the code. So it's not likely that a random signal coming out of the detector is going to exactly match either the P code or the N code. For that matter, since the

incoming signal is noisy, it's not likely that even a fairly *strong* transmitted signal will exactly match the P or N code either. But if most of the bits match (and it's up to the designer to define what is meant by "most"), then the correlator reports that it has recognized a 0 or a 1.

So let's just review some of the key points of the system:

1) The correlator sort of takes a majority vote on the chips, so it tolerates a certain amount of errors. Even so, it will often make a mistake, so some additional error correction is usually needed.

2) The P and N codes have to be different enough that there isn't a likelihood of mistaking one for the other. Even their parts have to be different, and this means that only certain P and N codes can be used. Still, there are many possible combinations.

3) A receiver can only decode a transmitted signal if it knows what P and N codes the transmitter used. Other transmitters using different P and N codes, even though operating on the same frequencies, appear as just noise. While they increase the overall noise in the system, they don't really interfere with reception unless they are very near. Thus, many transmitters can use the same frequencies without interference to each other, and they are often difficult to detect.

The FCC has recently opened up three bands (902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz) for unlicensed spread-spectrum operation. A variety of equipment, such as wireless headphones, cordless phones, burglar or fire alarms, and wireless modems, are already being marketed. There are even some integrated circuits which contain most of what you'd need for a simple spread-spectrum transceiver. Moreover, direct sequence spread-spectrum (under the name CDMA or Code Division Multiple Access) is being developed for cellular telephones as a means of allowing many more telephones to be used in a given area without interfering with each other. This is a big field, and getting bigger.

Digital signal processing

Another interesting new concept which may drastically change radio systems in the very near future is digital signal processing. A DSP (Digital Signal Processor) is essentially a specialized microcomputer IC, dedicated to processing analog signals. It takes an analog signal, converts it into digital numbers, processes the digital data in some way, and then converts it back into an analog signal.

Up until now, DSP circuits have been used in amateur equipment primarily to process the audio. For example, a DSP can analyze the received audio to identify constant signals (such as the whistles produced by interfering stations) and remove them. It can do the opposite too—identify those signals which represent voice signals, and amplify them more than other signals. In this way, the DSP has been used primarily to remove interference and noise.

As another example, several companies now manufacture noise-reduction headphones. Mounted on the headphone is a small microphone which picks up outside noise. A DSP circuit analyzes that noise, and then sends an equal but opposite signal to the headphone. This opposite signal partially cancels out the outside noise, reducing the noise level. The concept has also been used to counteract machinery noise.

Up until recently, DSPs have been plagued by slow speed, with the result that they could barely keep up with audio frequencies. But recent advances in DSP technology have speeded them up to the point where they are becoming fast enough to work at IF frequencies in receivers. This opens up an entire new area for them.

A number of manufacturers are working on receiver designs that consist of just three analog parts—an RF amplifier, oscillator, and mixer. The IF output from the mixer would then immediately be digitized by a DSP, and all other functions, including IF amplification and filtering, and detecting, would be done digitally.

The idea is actually driven by cellular radio. A cellular site normally needs a number of receivers, all tuned to different frequencies. Using DSPs would eliminate all this, replacing it with one RF amplifier, one oscillator, and one mixer. The resulting IF signal (which would actually contain a number of different received signals at the same time) would then be processed by several different DSPs, each one recovering the signal from one mobile or handheld cell phone user. When a cell phone switches from one frequency to another, instead of the cellular site having to switch receivers, the DSP would simply be reprogrammed to recover a different signal.

"Today's criminals can use these same techniques to avoid detection and capture."

The whole concept is still brand-new, and in its infancy. But we can expect the typical radio receiver five or 10 years from now to be very different from today's superhet!

Conclusion

As you can see, interesting and exciting things are happening in radio today. The advent of spread-spectrum communications is turning the industry around. Forty years ago, when CB or Citizens' Band radio started, so many people started using it that interference (and bad operating) made the band a shambles. Now spread-spectrum makes it possible for large numbers of people to share the same spectrum space without really interfering with each other.

Potentially, this is a tremendous improvement, but it can also lead to some problems. Just like the military developed spread-spectrum use over the years to provide security from detection, so today's criminals can use these same techniques to avoid detection and capture. I guess there isn't much we can do about that. 73

CW Enhancer

Making your signal stand tall.

Parker R. Cope W2GOM/7
8040 E. Tranquil Blvd.
Prescott Valley AZ 86314

When we listen to CW we would like to hear a "single signal," which means eliminating all the interfering signals. Eliminating all the undesired signals isn't really possible and we have to be satisfied with making the desired one stand out from the crowd. The filter described here does just that. It is tunable from below 300 Hz to above 3 kHz and has bandwidth variable from below 50 Hz to more than 5 kHz. The filter may strain out the signal but it doesn't strain the budget. It uses only one quad op amp (an LM324, available from Radio Shack™) and a few common resistors and capacitors.

Design equations are given to permit building filters for other applications in the audio frequency range. Of course, it's not necessary to understand the theory to build a filter that can improve your receiver's performance, but understanding the parts' functions allows adaption and use of the parts at hand.

The best filter for a receiver is a compromise of performance, complexity and cost. At first it would seem that a filter passing only a very narrow band of frequencies would be ideal. But using a very narrow filter in a receiver requires a slow tuning rate—if the receiver is tuned too quickly it can pass over a desired signal. A narrow filter also requires frequency stability in both the receiver and the transmitter. Some receivers drift for a few minutes (or hours) before they stabilize, and who can tell what the transmitter might do?

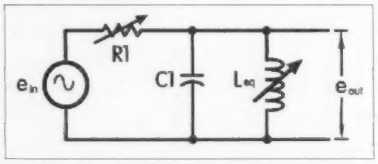

Fig. 1. A conceptual audio filter.

The CW Enhancer's center frequency and bandwidth can be adjusted to accommodate varying band conditions, and it has adjustable off-frequency rejection which is achieved by combining a portion of the full-bandwidth audio output of the receiver with the narrowband output of the filter. The narrowband signal is enhanced when the level of the full-bandwidth signal, including interference, is reduced relative to the narrowband signal.

Filters come in many shapes and sizes, each with its own set of advantages and disadvantages. All things considered, the active filter probably offers the best compromise for a multi-octave audio filter. The CW Enhancer is an active filter that requires no matched components and only one low cost quad op amp, one variable resistor to control frequency, another to control bandwidth, and a pot to control enhancement.

The conceptual audio filter shown in **Fig. 1**, while not particularly useful when a wound inductor is used, can serve as the prototype for a filter when an active variable inductor is used. The output across the tuned circuit is maximum at the resonant frequency. The resonant frequency of the filter is:

$$F_o = 1/ [6.28 \times (L \times C1)^{0.5}]$$

where F_o is frequency in hertz, L is inductance in henries, and C is capacitance in farads. L can be found by rewriting the equation as:

$$L = 1/ [(6.28 \times F_o)^2 \times C1]$$

The value of L needed to tune C1 from 300 Hz to 3000 Hz can be calculated with the second equation. C1 is arbitrarily chosen to be 0.01 µF and the value of L is found to be:

"The active filter probably offers the best compromise for a multi-octave audio filter."

$$L_{max} = 1/ [(6.28 \times 300) 2 \times 1 \times 10^{-8} = 28.1H$$

$$L_{min} = 1/ [(6.28 \times 3000) 2 \times 1 \times 10^{-8} = 0.281H$$

The 3 dB bandwidth of the filter in hertz is:

$$BW = 1/ (6/29 \times R1 \times C1$$

where C1 is in farads, and R1 is in ohms. When C1 is fixed, the bandwidth of the filter is controlled by the variable resistor, R1:

$$R1 = 1/ (6.28 \times C1 \times BW)$$

Assume C1 is 0.01 µF, then a bandwidth of 50 Hz requires R1 to be 318k. The nearest standard potentiometer value is 500k. Therefore, when R1 is 500k, the nominal minimum bandwidth is 32 Hz. When R1 is 5k, the bandwidth is 3.2 kHz. A resistor in series with R1

will limit the maximum bandwith if the range of bandwidths needs to be restricted.

In the CW Enhancer the variable inductance shown in **Fig. 1** is synthesized with a General Impedance Converter (GIC), shown in **Fig. 2**. The GIC, comprised of A2, A3, R2, R3, R4, R5, and C2, replaces the inductance L. The inductor synthesized by the GIC has an equivalent inductance of:

$$L_{eq} = C2 \times R2 \times R4 \times R5 / R3$$

where L_{eq} is in henries, C2 is in farads, and the Rs are in ohms.

"The best filter for a receiver is a compromise of performance, complexity, and cost."

Since R2, R3, R4, and C2 can be made constant, the inductance L_{eq}, and consequently the tuned frequency, F_o, can be controlled by R5. When R2 = R3 = R4 = R5 = R the expression for L_{eq} reduces to:

$$L_{eq} = C2 \times R^2$$

The value for R^2 can be calculated to show the general range of values of the resistors required in the GIC. A convenient value of C2 is 0.01 µF and R^2 is calculated to be 2.81 x 10^9 to produce 28.1 H. Therefore, R is approximately 53k . Since 50k is the nearest standard pot value available for R5, R2, R3, and R4 are recalculated to be 56k. The value of R5 needed to produce 0.281 H is 500 ohms.

The CW Enhancer shown in **Fig. 3** uses a GIC to synthesize a variable inductor to resonate with C1 over the frequency range. The bandwidth is controlled by R1. A fraction of the full bandwidth audio signal, determined with the enhancement control R6, is summed with the output of the resonant circuit. The resonant circuit is isolated from the summing amplifier A4 by the non-inverting unity gain buffer A1. The "enhancement" control, R6, controls the level of the full bandwidth signal without changing the level of the filtered signal.

The output of A4 can drive 20 mA into a short circuit or swing a 1k load to within a volt of the rails. This equates to about 1.5 mW into low impedance (8 ohm) phones or 20 mW into 600 ohm phones. For more audio power Radio Shack's mini-audio amplifier P/N 277-1008 at $11.99 will certainly do the job, but a simple emitter follower as shown in **Fig. 3** is much less expensive and is adequate for most situations. The speaker or phones are capacitively coupled to eliminate DC in the load. A 100 µF coupling capacitor produces a low cut-off frequency of 198 hertz with an 8 ohm speaker. That is, the response at 198 hertz is down 3 dB (half power) from the response at 2 kHz. When 600 ohm phones are used, the coupling capacitor can be reduced to 2.2 µF.

The LM324 quad op amp shown in **Fig. 3** is pin-for-pin compatible with the MC4741. These ICs contain four independent operational amplifiers identical to the MC1741 packaged in one 14-pin DIP. Of course, the quad op amp can be replaced with four individual 741s if they are more available.

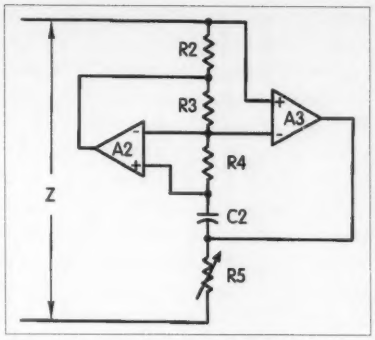

Fig. 2. The General Impedance Converter can look like an iductor. See text for formulas.

The power supply for the circuit is not especially critical; a 12 volt supply is convenient. When a 12 volt supply is tapped at 6V, the tap may be considered "local ground" and the op amps effectively operate from +6V and -6V. Of course, the +6V and -6V supplies could be developed idividually. The "local ground," V_R, is obtained by tapping a single 12V supply with R10 and R11 in **Fig. 3**. The +12 volt input is 6 volts above "local ground" and the

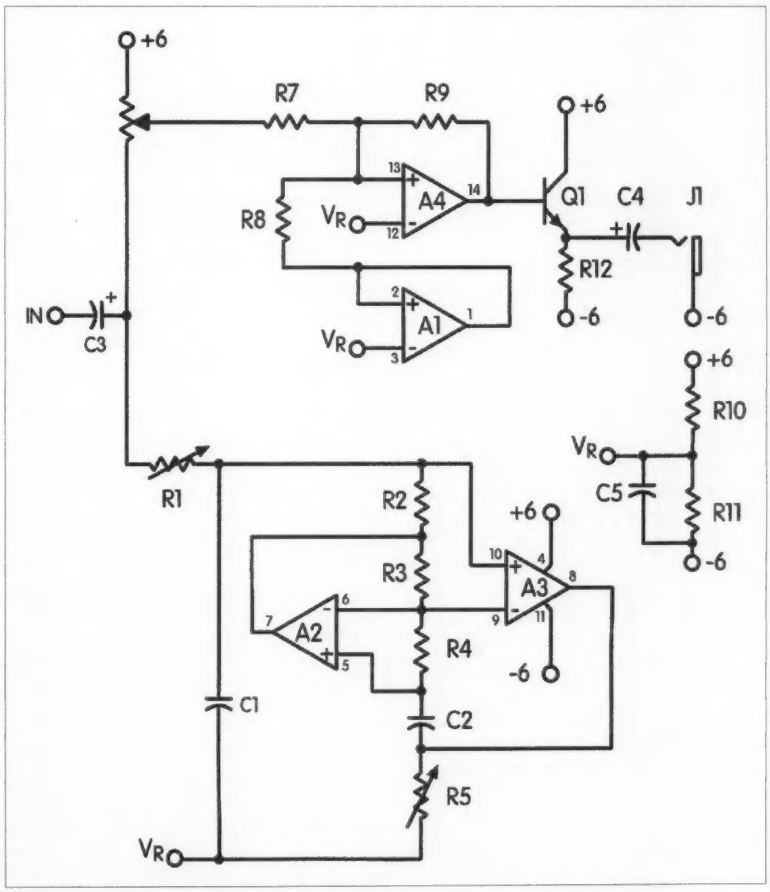

Fig. 3. The CW Enhancer uses GIC to synthesize the inductor in an audio filter..

negative side of the input supply is 6 volts below "local ground."

The maximum power into 600 ohm phones is limited by the supply voltage. With 8 ohm phones, the maximum power is limited by the peak transistor collector current. A different transistor with higher collector dissipation could supply more power if needed. Since the Enhancer's voltage gain is about unity, the maximum input from the receiver should be limited to about 3.5V (5V peak) with 600 ohm phones or 0.28V (0.4V peak) with 8 ohm phones or speaker.

The Parts List for the CW Enhancer of **Fig. 3** is given in **Table 1**. Most Radio Shack stores will special order the potentiometers from Radio Shack Unlimited (RSU). If not, they are available from any industrial electronics distributor, such as Digi-Key.

The CW Enhancer is a relatively simple project whose performance belies its simplicity. The three controls: "Enhancement," "Bandwidth," and "Frequency," enhance the CW capabilities of a basic communications receiver. Construction time is just an evening or two but the enjoyment it brings goes on and on. 73

Parts List		
C1, C2	0.01 ± 10% µF film capacitor	Radio Shack # 272-0165
C3	2.2 ± 20% µF electrolytic capacitor	272-1435
C4, C5	100 µF electrolytic capacitor	272-1016
J1	1/4" single circuit 2-conductor phone jack	274-252
Q1	NPN transistor, h_{FE} > 40	MPS3904
R1	500k ± 20% 1/4W potentiometer	RSU
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R5	50k ± 20% 1/4W potentiometer	271-1716
R6	5k ± 20% 1/4W potentiometer	271-1720
R7, R8, R9, R10, R11	10k ± 5% 1/4W fixed resistor	271-1335
R12	470k ± 5% 1/4W fixed resistor	271-1317
U1	LM324 quad op-amp	276-1711

Table 1. Parts list for the CW Enhancer.

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Ham Television

Bill Brown WB8ELK
138 Angela Dr. Apt. B
Madison AL 35738

Just before sunrise on September 22, members of a group called HALO (High Altitude Lift Off) gathered at the old airport in Huntsville, Alabama, to fly an unusual balloon mission. This was part of an ongoing series of test flights to prepare for a rockoon flight this winter. The rockoon is a rocket launched from a balloon platform floating at 90,000 feet. Since this is above most of Earth's atmosphere, the rocket should fly briefly into space (over 60 miles high).

Also attached to the fuel tank payload was a low-power tracking beacon designed by myself WB8ELK, with a 68HC811E2 microcontroller which sent down CW altitude and temperature telemetry via a 147.45 MHz 2 milliwatt FM transmitter (audio CW) based on the Motorola MC2833P chip. In addition, the telemetry was simulcast on 28.800 MHz CW (20 milliwatts) using a keyed clock oscillator.

The balloon used was a special 19k cu.ft. Raven zero pressure balloon, which is quite different from the standard weather balloons used in previous flights.

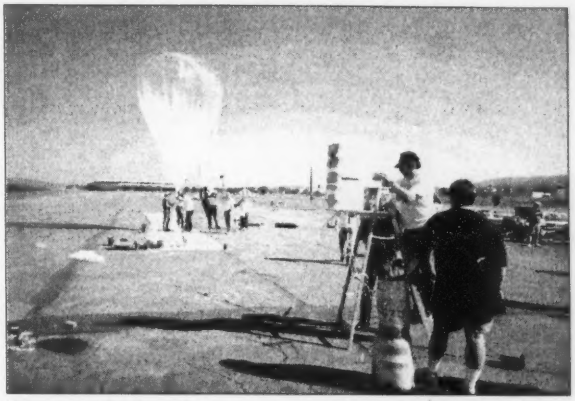

Photo A. The launch crew prepares the ATV telemetry and tank experiment for liftoff as the balloon is inflated. (Photo by Gene Marcus W3PM.)

"It was just like taking an elevator to the edge of space."

The flight system

The experiment payload consisted of a nitrous oxide fuel tank with pressure and temperatures probes inside to study the effects of the balloon flight. We need to maintain good pressure in order to fire our hybrid rocket from the balloon. The rocket is a hybrid consisting of a nitrous oxide tank and asphalt. Our ground-based launch of the rocket achieved nearly 30,000 feet last spring.

The ATV/telemetry payload was built by Ed Myszka KE4ROC and consisted of a live color TV camera hooked up to a PC Electronics KPA-5 ATV transmitter on 434 MHz (a microphone was attached to the audio subcarrier), a big wheel antenna built by Gobe W4WAD, and a sensor decode system consisting of two Basic Stamp IIs hooked to a GPS/Pico-Packet combo. Telemetry and position information was sent down in an APRS format on 145.79 MHz.

Ed mounted all of his electronics into a sturdy but reasonably lightweight aluminum frame of his own design and covered it all with Styrofoam™ for thermal insulation. This balloon is made out of a plastic film with a vent duct in the bottom. At altitude, instead of bursting, it actually vents out the excess helium and will level off until sundown or until we cut it loose with a cutdown device.

Adventures in flight

As we laid out the balloon (70 feet long uninflated) on the pavement of the old airport runway, many of us commented on just how perfect the conditions were for our first attempt at such a large system. Not even the slightest breeze disturbed our efforts as we pumped almost four tanks of helium into the balloon envelope (approximately 1,000 cubic feet of gas).

After about two hours of preparation we were ready to launch. The balloon towered over us and was quite a spectacular sight as it reflected the early morning light. However, just as we were ready for liftoff, we encountered a problem with our rigging and retrieval system which required a trip back to the workshop to get some parts.

We sat there with a huge bag of helium for nearly an hour. Then, just as the crew returned with the parts, Mother Nature finally figured out that there was this big, beautiful balloon just sitting peacefully on the ground. She started to play with it with wind gusts, just like a cat does with a mouse. It was quite a sight to see everyone running around under the balloon trying to keep it from hitting the rough abrasive surface of the old runway. Unfortunately, one particularly strong gust caused it to graze the runway and tore two large holes in the side of the balloon. We taped the holes shut in the hope that it would hold throughout the flight, then launched it during a brief lull in the wind.

The balloon glided across the runway and the bottom payload promptly snagged on what

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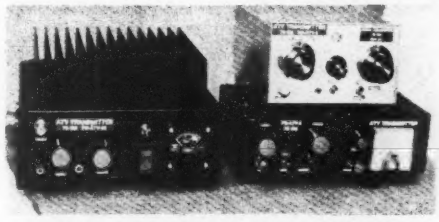

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***Photo B.** The inflated Raven balloon stands nearly 40 feet tall. (Photo by Gene Marcus W3PM.)*

appeared to be a power line near the edge of the runway (see **Photo C**). There it was 20 feet up with the balloon sailing out like a kite. Fortunately, this turned out to be an unpowered audio line to some loudspeakers, so I got a long pole out of my car and was able to hook the radar reflector and drag the whole thing off the line. Ed KE4ROC grabbed hold of the payload, ran forward and gave it a big push. Everyone cheered and yelled when everything finally headed off smoothly on its way to the stratosphere after narrowing missing another set of real power lines. When we played back our videotape recording of the payload's point of view, it was quite entertaining to hear and watch everyone running around like crazy under the payload as we tried to free it from the line.

Elevator ride to space

The payload rose upward at a very leisurely 620 feet per minute. The video image was very stable, with absolutely *no* twisting or turning of the payload. Those zero-pressure balloons are nice! It was just like taking an elevator to the edge of space. Since it was a very clear day, the TV camera view of downtown Huntsville and the surrounding suburbs was fantastic. The APRS telemetry worked great and everything was operating smoothly except that telemetry from the pressure and temperature sensors inside of the nitrous oxide fuel tank was intermittent. At 39,000 feet we noticed that the balloon was starting to descend slowly (around 500 feet/minute). Apparently the taped-up holes had sprung leaks and were slowly letting the helium out.

Unidentified floating object

Since the payload was descending so slowly, we decided not to fire the cutdown mechanism to allow the system to fly farther into Georgia and land it closer to the Atlanta area foxhunters who were preparing to chase the payload.

Ralph Fowler N4NEQ organized a chase team to track down the payload. He had an APRS system in his car and we could not only track the balloon's position on our ground station back in Huntsville, but we could track his chase vehicle closing in on the payload as well.

After traveling 108 miles from the launch site, the balloon landed at 1:59 p.m. in a kudzu patch behind the back yard of a house southwest of Dallas, Georgia.

The owner of the house was washing dishes and saw the payload land in a field behind her yard. She thought that a UFO had landed and called the TV and radio stations in the area to report the sighting. She turned on her scanner to see if anyone else had reported the UFO, actually ran across the chase crew on 2 meters—and realized that aliens *weren't* invading Georgia.

The payload survived the landing in good shape and was handed over to Robert KE4GNN, one of our group, who had chased after the balloon from Alabama.

Post-flight results

We learned a lot about flying large balloons and received enough telemetry data to consider the flight to be a success. A balloon flight of this size requires lots of planning and coordination with the FAA. Launch permission needs to be received in advance and we were in constant contact via cell phones to both the local airport's tower and the regional FAA center. They were able to track the balloon system on their radar screens; apparently our radar reflector worked just fine (the reflector is available from Kaymont, 800-644-6459).

For more info about the balloon flight (complete with photos and charts) and details about the telemetry system, check out my home page at the following Internet web site:

http://fly.hiwaay.net/~bbrown/

This page also contains many links for balloon information and other groups. 73

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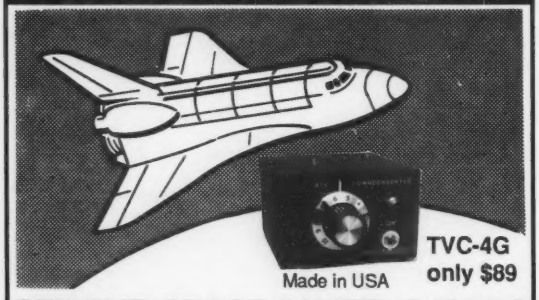

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***Photo C.** The balloon is shown attached to our telephone pole test facility to allow for a photo opportunity and final system testing. Attaching the payload to the phone line requires pinpoint accuracy during the initial launch phase. (I work for the government, so I can put a positive spin on just about any disaster!) (Photo by Gene Marcus W3PM.)*

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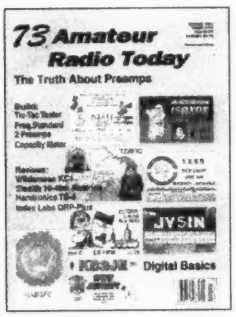

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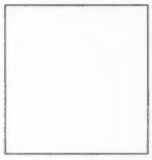

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As I write this column, autumn has just begun, but our much-celebrated *Hagerstown Almanac*, published here in Maryland, says that this will be a cold, cold winter. If that's the case, some of the items covered this month should give some of us something to do while the snow melts. Now, with this magazine hailing from New Hampshire, and my living in Maryland, those of you with balmy December weather can just hold your peace.

"Some of the items covered this month should give some of us something to do while the snow melts."

Software for the Kaypro?

From up in New Hampshire I received a letter from Mike Murphy WB2UID, who says, "I have not been exposed to RTTY yet. My station plans are fairly simple, with a Heath Marauder and a Collins R-390A and SSB converter. The Heath is massive and has 100% duty cycle capability; it should work great. I like the idea of using my PC and some kind of filter/adapter circuit to do RTTY or AMTOR.

"I have an old Kaypro 2 (King of the CPM Z-80s?) with dual floppy drives under my workbench at home. Is this thing still useful as a RTTY or CW terminal? I fired it up and it runs WordStar! It is fully metal-shielded, sort of portable, and looks like it would make a nice rig to build a converter into—lots of space inside. Any chance that any CPM software still exists for the Kaypro?"

Well, Mike, there is, and then, again, there may not be. I did a search of available archives and while I turned up a bit of CPM software still around, only one program seemed to be applicable to your situation, a program called RTTY2.LBR. This is a "library" file, a precursor of today's archived or zipped file, that appears to contain RTTY routines for CPM. I have no way of extracting or looking at these files, so I pass along this information for what it is worth. Along with sending you the file, I pass along the information that other CPM files may be found at the Oakland University Archives, on the World Wide Web at http://oak.oakland.edu/oak/cpm/hamradio-pre.html. The files are also on the Oakland FTP site if that is more convenient for you. Additionally, I will have a link to the file on the Download Page of the RTTY Loop Home Page; see the address at the end of this column. Let me know if this file is useful to you, and how you do with the CPM efforts.

New DOS program

After CPM came DOS, of course, so, logically, we should take a look at a new DOS program. Well, you have got to see the new HamComm, version 3.1. This little gem, written by W.F. Schroeder DL5YEC, runs under DOS rather than Windows© 3.x, 95, or NT; or OS/2. It supports reception and transmission of radioteletype (RTTY), AMTOR ARQ/FEC, SITOR A/B, NAVTEX and Morse code (CW) signals. A decoder for SHIP and SYNOP reports from weather stations is also included. PACTOR decoding is available with the registered version. It does not require a RTTY converter, not even a modem chip. The audio output of the transceiver is connected to the serial port of any PC/XT/AT compatible computer through a very simple, low-cost interface. Only one IC is needed (Op-Amp TL071 or similar) and a few diodes, capacitors and resistors. Whether or not this would work with simple computer modems such as the CP-1, I do not know.

For transmission, a tone signal is available at the COM port which can be connected to the microphone input of the transceiver through a passive RC filter. Audio frequency decoding and serial/parallel conversion are all done in software.

HamComm will automatically detect the type of video adapter in use. MDA, CGA, EGA, VGA and Hercules are supported. All graphics routines are written in assembler for speed. No attempt has been made to avoid screen flicker (snow) on cheap CGAs.

HamComm may work to some degree on XT machines, but the graphics displays of the input signal are more fun to watch on an AT-class computer. Nearly all of the functions can also be controlled by using a mouse. A hard disk is recommended but not required. All texts are written in English, and the online help system includes the schematics for the interface circuit. There are also predefined standard phrases, a QTH distance/direction calculator and a callsign decoder. Currently about 370 kbyte of free RAM is required. The interface schematics are included in the online help texts and there is also a section on troubleshooting in case of hardware problems.

HamComm 3.1 is shareware, with a $30 payment due after a 30-day evaluation period. It is an excellent program, with a good track record in previous incarnations, and many "RTTY Loop" readers have used the program with good results.

You can obtain HamComm on the RTTY Loop Download page, as well as in the RTTY Loop Software Collection Disk #13. Details for obtaining this disk are at the end of this column.

Windows software

Windows users, we have not forgotten you. Gary Johnson KF7XP has just released an updated version of his XPWare for Windows Version 1.1.1. This new update supports AEA, Kantronics (KPC-3, KPC-9612 and KAM), SCS (PTC, PTC-Plus and PTC-II), PacComm (PTC and PTC-II) and Hal P38, PCI4000M and DSP-4100 multimode controllers. It allows transceiver control (with appropriate interface) for Kenwood, Icom and Yaesu (FT-767, FT-840, FT-890, FT-900, FT-990, FT-1000 and FT-1000MP). It supports DX cluster spotting, voice announcement on connects and DX spots, ANSI and Bit map graphics, one-key brag files and test, Callbook interface (SAM, QRZ!, Buckmaster and Radio Amateur Callbook), binary file transfers for Clover, GTOR, packet (YAPP) and PACTOR. The program can run one or two controllers at a time (may be different types and brands)—and much much more. Registration cost is $80; upgrade cost for users of XPWare DOS program is $45.

With one program able to do so much, this affordable program can be "test driven" by downloading from either the RTTY Loop Download Page or Gary's web site at: http://www.indirect.com/user/gjohnson . Gary's controller-specific versions under DOS have been fabulous; this one looks to be even better. Take a look if you are hunting for a flexible program to interface one of the supported devices.

For those who came in late, the Software Collection referred to above is a 13-disk assembly of programs of interest to amateurs on radioteletype. Each disk collection may be obtained by sending a blank 3.5" HD disk, a self-addressed, stamped mailer to return the disk to you, and $2 in US funds per disk to the address at the top of this column. A listing of the contents of each disk can be sent to you for a self-addressed, stamped envelope sent to the same address. Alternatively, you may find the complete list, and some programs, on the RTTY Loop Home Page at http://www2.ari.net/ajr/rtty/, where past columns, programs, and other trivia are available, along with links to other interesting sites on the World Wide Web. Let me know what you are thinking, via mail, or via E-mail at: ajr@ari.net, or MarcWA3AJR on AOL, or 75036,2501 on CompuServe. I look forward to hearing from you. See you in '97! 73

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Wayne's Submarine Adventures in WWII

These stories were originally published in the *Drum Newsletter* to encourage crew members to come to the yearly *Drum* reunions in Mobile, where the *Drum* is on display in Battleship Park, next to the *Alabama*. If you visit the *Drum* you'll see many of these newsletters on display. Submarine life was boring most of the time, but suddenly there was intense action. You'll read about the times we came very close to being sunk – and a couple times when I saved the boat from disaster. You'll also read the inside story on the Amelia Earhart spy mission. Says Jim Walter W9AZO, "I just re-read your sub adventures in WWII – great stuff – enjoyed every page!"

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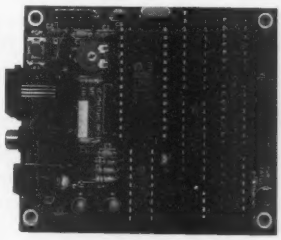

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CIRCLE 248 ON READER SERVICE CARD

Saving the Amateur Radio Spectrum

A case supporting amateur licensing fees.

Charles M. Seay, Sr. KN4HL
106 South Main Street
Dickson TN 37055

The amateur radio bands are under attack again, especially the 2 meter band and the 440 MHz band by LEO (low earth orbit) companies needing frequency space for new services. The need for more radio spectrum will accelerate in the future with the development of more electronic gadgets. What better place to look for more spectrum than the amateur radio bands?

Why should our bands be such a fertile area for commercial expansion? Because they are not a revenue-producing source for the federal government. The FCC and Congress have seen the enormous revenues that can be obtained from radio spectrum auctions. The more demand generated for radio frequency spectrum, the more valuable our bands will become.

Even though there are over 600,000 licensed amateur radio operators in the United States, these numbers are not significant enough to be politically powerful. Political power is based on numbers. The amateur radio community just doesn't have the numbers to protect its interests, either with the FCC or with the final authority, Congress.

The American Radio Relay League membership represents only a small portion of the licensed amateurs in this country. They are, however, the only game in town when it comes to representing the amateur community. Members are paying over 30 dollars a year for a magazine and no political clout when the final votes are counted. As an example, I direct your attention to the bill introduced by former Tennessee Congressman Jim Cooper, which was designed to protect amateurs from the loss of more amateur spectrum. Even with all its urging, the ARRL could not muster the support of enough representatives and senators to get this bill passed into law. Why? There was no economic incentive for members of Congress to pass such a bill.

"If you can afford a rig, you can afford a license fee."

Have you ever asked yourself why people and corporations make such big contributions to politicians running for office and their political parties? Or why groups and corporations are supporting thousands of lobbyists in a manner you wish you could afford? It is to have access to the powers that could control the economic destiny of that contributor. I can assure you that the presidents and CEOs of communications companies have more access and input to the decision-making process of the FCC and the Congress than the political arm of the ARRL. It's not that the presidents and CEOs are nicer than the president of the ARRL, it's a matter of money.

It's time that amateurs get their heads out of "OZ"; Dorothy and Toto do not exist. Your ability to enjoy the great hobby of amateur radio will come down to the U. S. Dollar. It will involve a decision on each of our parts to pay for enjoying our hobby.

What, *pay* for my God-Given Right to use the amateur radio spectrum? Yes, indeed. If you play golf, swim, hunt, fish, or ski, you pay a fee each year for a license, or greens fee, or a lift ticket. Why should amateur radio be given a free lunch? The bottom line is—we shouldn't.

I have heard the howls that we amateurs should not be charged a license fee because we provide a public service. This is true to a small extent. The fact is that

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amateurs, as a group, don't do enough public service to justify the free spectrum. You've also heard that license fees would make the hobby unaffordable to some. Get real, pal. If you've bought any amateur gear in the past few years, you know that we are in an expensive hobby. If you can afford a rig, you can afford a license fee.

I think that a $50 fee for a five-year license would not be out of proportion with the other expenses we incur with our hobby. Small fees for changes of addresses and callsigns, and license exams would be appropriate. It is a matter of economic fact that if we want to play, we are going to have to pay our fair share.

Under the burden of this country's budget deficit, politicians are looking at every conceivable source for funds to support their pet projects. We amateurs can sit around, then bawl and bellow as our allotted radio spectrum is sold out from under us, or we can make our part of the radio spectrum economically justify its existence.

This proposal is not one-sided. With the payment of license fees, the amateur community has every right to expect that the FCC will do a better job of policing the amateur radio spectrum. It is time the FCC enforced their own rules, something they've been neglecting for several years. One of the reasons for this neglect is the lack of funding by Congress for this police action.

It all comes down to money. We complain to the FCC about the garbage on our bands and nothing is done because there is no money. We complain about the loss of our bands to commercial interests and we lose radio spectrum because there is no economic justification for our space. It's time we paid the piper—the dance is just about over.

Note: The above will, I hope, be a dose of reality salts for hams who are ignorant of how our government works. But $10 a year for a ticket is insignificant. To have any hope of clout against Motorola, G.E., Matsushita, Sony, Hitachi, Toshiba, et al., we're talking more like $100 a year. And that, if we can hold on to a half million hams, would still only be $50,000,000 a year—while the FCC is bringing in billions with their spectrum auctions. If we had to pay for our licenses we might have more respect and less trashing of our hobby on the air. We could also expect more help from the FCC with our garbage collecting. Most people just don't respect anything that's free! ... Wayne. 73

LED Checker Plus

Make it even more useful.

Tom Thompson
Box 49481
Blaine MN 55449

If you have already built the LED Checker (see *73*, January 1989, p. 61), then I have a simple change that will turn it into an even more versatile bench tool.

Several new options are available with the Plus model, such as in-circuit testing of LEDs including displays, polarity testing and identification of diodes, and an external DVM connection for forward voltage measurement, which is helpful in determining if a diode is silicon, germanium or a Schottky type.

The original circuit

First, familiarize yourself with the original circuit (**Fig. 1**) The basic circuit is the same, except without the two jacks for external test leads added in this enhancement.

The operation is simple! Insert the LED into the test socket and press S1. If the LED is on, it is good. If it's not on, turn it 180 degrees and put it back into the test socket. Press S1 and the LED should be on. If not, it is defective.

The modification

See **Fig. 2**. The "Plus" model merely has wires W1 and W2 added to the original circuit directly to the "+" and "-" terminals of the test socket. These wires are then soldered to J1 and J2, a pair of five-way binding posts (RS-274-662). The red binding post should be connected to the "+" and the black to the "-." You can mount the binding posts wherever you want, but the industry standard is 3/4" between centers. Or you can also use banana jacks, which are less expensive.

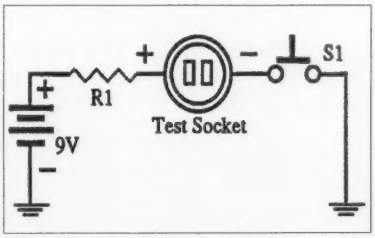

Fig. 1. The original LED Checker circuit.

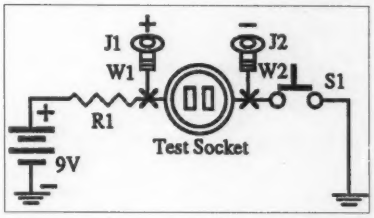

Fig. 2. The improved LED Checker Plus allows measurement of forward voltage drop, as well as in-circuit tests.

In-circuit LED testing

See **Fig. 3**. For in-circuit LED testing you connect your clip leads "+" and "-," then clip them to the two LED leads and press S1. If the LED goes on then it is good. If it doesn't then you reverse the leads and press S1 again. If the LED is still not on then it is bad.

In some cases, if several LEDs are in parallel or there is too much current being drawn by the circuitry then you may have to unsolder one of the leads to isolate it from the rest of the circuitry.

Diode forward voltage testing

This testing is usually done to determine the voltage drop across the diode while it is on. To check diode forward voltage, connect your DVM to the Checker, red to "+" and black to "-." Set the DVM to DC volts on the 2 or

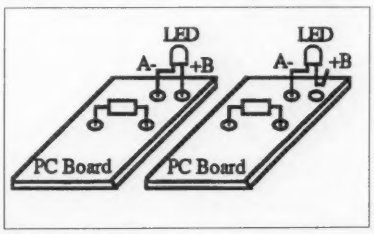

Fig. 3. The LED Checker Plus can be used in-circuit.

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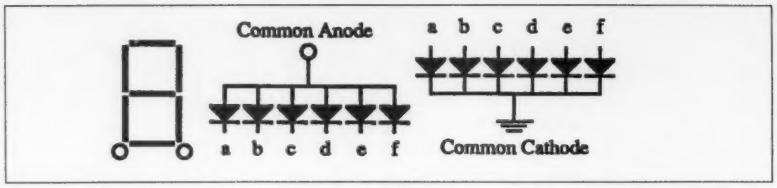

Fig. 4. Seven-segment displays are available in either common anode or common cathode configuration.

20 volt range (this will vary with different models of voltmeters). Put the diode into the socket and press S1. If the diode is in correctly the voltage measurement will appear on the display. If not, reverse the diode and try again. Remember, you must press S1 each time you test. A silicon diode will have a voltage drop of about 0.7V (1N914); germanium will be about 0.4V (1N34); Schottky 0.3-0.4 (1N5818); and any LEDs 1.4-2.4V. Your tester pulls about 10 mA, so if you have a data book you can check the forward voltage at 10 mA to determine what voltage to expect for a given diode type.

"I checked a two-digit display on which I had no information and had all the pins identified in five minutes!"

Seven-segment display testing

In testing seven-segment displays you'll find one of two types: common anode or common cathode (see **Fig. 4**). The key here is to locate the common lead. If you are working from a schematic then look for a "+" connection for a common anode and a ground "-" connection for a common cathode.

If you don't have a data book you'll have to guess, but that's easy. Common anode displays usually use pins 3 and 14; common cathode displays usually use pins 1 and 6. This is a good place to start.

If your deduction indicates that the display has a common anode then connect the "+" lead to the common pin or the lead you suspect to be common, and attach the "-" lead to any of the remaining pins. Press S1. If no segments turn on move the "+" lead to each lead, pressing S1 after each connection. Once you get a segment to turn on you have found the common lead. Keep the "+" connected where it is and move the negative lead around until all the individual segments come on one at a time. If you have a common cathode then connect the "-" to the common lead and attach the "+" lead to any of the remaining pins, pressing S1 each time. Make some notes to keep track of your progress. Remember, your LED Checker limits the testing current to a safe value so it will not damage a display.

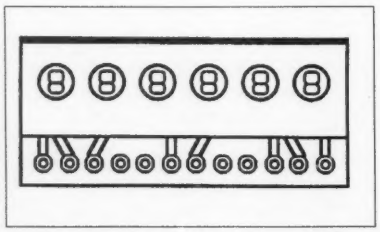

Fig. 5. A typical six-digit multiplexed display.

Multiple-digit display testing

Multiple-digit displays usually have common segments but have separate anodes or cathodes for each digit. You need to find all the digit pins as well as the segments. This is relatively easy and is done by noting what segment is on and what digit position it is located in. Make a drawing as you do the testing. I checked a two-digit display on which I had no information and had all the pins identified in five minutes! More complicated displays, such as that shown in **Fig. 5**, may take 10 to so minutes.

Well, that's about all there is to using the LED Checker Plus. Maybe you can think of some other unique uses and share them with the other readers!

A kit for the basic LED Checker Plus is available for $10.95, plus $2.50 shipping and handling, from Home Net, Box 49481, Blaine MN 55449. It's also available on Home Net BBS @6127559661. 73

SPECIAL EVENTS

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 30. Provide a clear, concise summary of the essential details about your Special Event.

NOV 22–23

OCEAN SPRINGS, MS The West Jackson County ARC, Inc. will present a Hamfest/Swapfest at the Latimer Comm. Center, north of the city of Ocean Springs. Swap and Flea Market tables are $5 each, to be paid in advance. Mail table reservations to *WJCARC, P.O. Box 1822, Ocean Springs MS 39564.* For details, contact *C.F. Kimmerly N5XGI, (601) 826-5811;* or *Mike Gurley KC5QXE, (601) 475-6161, after 5 PM.*

DEC 1

HAZEL PARK, MI The Hazel Park ARC will sponsor their 31st annual Hamfest, 8 AM–2 PM, at Hazel Park H.S., 23400 Hughes St. Free parking. Reservations for eight-foot tables ($14 each) must be received with a check. No reservations by phone. Send payment to *HPARC, Inc. Swap, P.O. Box 368, Hazel Park MI 48030.* Talk-in on 146.640/443.225 DART Rptr. Six-foot tables available at the door for $10; limit one table per customer while they last.

DEC 7

GOLDEN VLLEY, MN The annual Courage Center Handi-Ham Winter Hamfest will be held at the Handi-Ham Headquarters, 3915 Golden Valley Rd., starting with registration at 8:30 AM. There will be a Handi-Ham equip. Auction, Flea Market, Dinner at noon, and Program. Contact *Don Franz WØFIT, 1114 Frank Ave., Albert Lea MN 56007.*

DEC 14

JACKSONVILLE, IL The Central Illinois Winter Superfest, sponsored by Illinois Valley ARC and Jacksonville ARS, will be held 8 AM–2 PM at Turner Jr. H.S., 664 S. Lincoln Ave. Vendor setup at 6 AM. VE Exams at 10 AM, pre-reg. required. Contact *Tim Childers KB9FBI, 773 E. College, Jacksonville IL 62650; Tel. (217) 245-2061.* Talk-in on 146.775(-), and 444.675(+). Advance reservations taken until Nov. 30th. Send SASE and check payable to *Jacksonville ARS c/o Kaye Green KB9KHQ, 27 Ivy Wood Drive, Jacksonville IL 62650.*

LAKE CITY, FL The Columbia ARS will hold its 2nd "Gateway to Florida" Tailgate/Hamfest at Robert B. Harkness Florida Nat'l. Guard Armory, 153rd Engr. Co., Lake Jeffery Rd. Call (904) 755-7969 for details. Talk-in on 145.490 (-), alternate 147.150(+).

SPECIAL EVENT STATIONS

DEC 6–DEC 7

MESA, AZ East Valley Amateur Radio Group, WA7USA, will commemorate the Battleship USS Arizona, from 1500Z–2400Z on 14.240 MHz and 21.340 MHz. Stations contacted may request a certificate by sending a QSL card and a 9" x 12" SASE to *EVARG, 3264 E. Carol Ave., Mesa AZ 85204-3245*

DEC 14

CHRISTMAS, AZ The TriCity ARC will operate from Christmas AZ in celebration of the Christmas season. Phone operations will take place from 1500 UTC–2100 UTC, on 7.225 MHz(+) and 14.240 MHz(+). Send QSL and SASE to the event callsign's *Callbook* address. Callsign to be announced.

DEC 14–DEC 15

NAZARETH, PA The Delaware-Lehigh ARC will operate W3OK (or possibly WX3MAS) as the Christmas Cities' Special Event Station. The station will be on the air 1400Z–0200Z from the twin Christmas cities of Nazareth, PA, and Bethlehem, PA. Freq.: 3.965, 7.265, 14.265, 21.365, and 28.365. For a certificate, send QSL and a 9" x 12" SASE to *DLARC, RR 4, Greystone Building, Nazareth PA 18064 USA.*

DEC 14–26

BELEN, NM The Valencia County ARA will operate KC5OUR 1800Z Dec. 14th–0000Z Dec. 26th to celebrate Bethlehem. (Belen is the Spanish word for Bethlehem.) A QSL card will be sent to all who provide an SASE. QSL to *KC5OUR, 93 Nash St., Belen NM 87002 USA.*

JAN 1997

GISBORNE, NEW ZEALAND The amateur fraternity is fast heading into a new century, with the year 2000 rapidly approaching. To acknowledge this event, the Gisborne ARC (Branch 11, NZART) will sponsor an annual international award, using the callsign ZL2000, until the year 2000. The award is open to all amateur radio operators and SWLs. To achieve an annual award, only one contact is required with a ZL2000 station during the month of January each year, until the year 2000. A special complimentary award will be issued to all stations that contact a ZL2000 station for four out of the possible five years, up to and including the year 2000. The fee for the annual award in New Zealand is $5, for Australia $5, and for the rest of the world US $10. Contact Gisborne 2000 Award, P.O. Box 1017, Gisborne, 3815, New Zealand.

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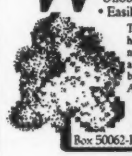

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December already? Yes, it's true, 1996 is coming to an end. I sure hope the year was better for you than for me. Whatever I touched or did seemed to come apart this year. Let's hope 1997 is better.

Aside from the lack of sunspots, operating QRP has been an exciting hobby within ham radio. We've seen all sorts of new gear tailor-made for QRPers. Some of the gear is getting rather fancy compared to what we have become accustomed to.

Small thin film solar modules for QRP use

I've had several letters asking about soldering wires to thin film solar panels. These amorphous silicon panels have been turning up at surplus stores around the country. Some of the prices have been very attractive as well—but the downside is that there are no wires connected to the modules. In fact, when a thin film module is made, it can easily be cut up into even smaller modules, only a glass cutter. This is what happens if the buyer gets a shipment of large modules. If the guy who does the cutting keeps the same amount of cells, the modules will always be the same voltage, but will generate small currents. The amount of current is dependent upon the physical size of the module.

Now, to make matters even worse, you just can't solder wires onto the glass substrate of a thin film module! In late August, I spent a week at Solarex in Frederick, MD. One of the first questions I asked was, "How do you solder wires onto the back of a thin film module?" Their answer? You don't. Here's the whys and the why nots of soldering to a thin film solar module.

The backside of the thin film module is made out of a substrate of either tin oxide or aluminum oxide. Both are deposited on the glass by flashing the material (let's say aluminum) onto the glass or in a plasma chamber. The coating is only several microns thick. So, with a material so thin, there's not much to hold onto.

Since we don't know what the substrate is made of we can try one (or both) of two methods. First, a silver solder, with a high content of silver, should work with the tin oxide substrate. The silver solder must have a very low melting point. If the melting point is too high, the tin oxide is burned away before the solder has a chance to stick.

If the silver solder did not work, then the substrate must be aluminum oxide. We can then try some aluminum solder. Right off hand, I don't know of a source for this stuff. The aluminum solder must also have a low melting point. You'll also need an adjustable soldering iron; you must lower the operating temperature of the tip to prevent burning off the oxide.

"A thin film module about the size of this magazine will produce about 3-5 watts under a full sun."

A cheap and dirty way to make your soldering iron so you can vary the tip's temperature is to use a lamp dimmer. You can get these from any home improvement center.

If, by chance, you manage to get the wires soldered, then you must protect the connections. Remember, there is not enough material for a strong joint. A coating of RTV or hot melt glue will be needed to secure the connections. With a lot of luck, you may be able to make connections to the backside of a thin film module.

If you do, then apply a film of RTV around the edge of the glass. Water will seep up into the active material if you don't. Solarex prevents this by using a laser to burn off a strip of active material all along the edge of the thin film module. This effectively isolates the active material from the glass edge.

A thin film module about the size of this magazine will produce about 3-5 watts under a full sun; combining this module with a small gelled lead acid battery will power most of the single-band QRP rigs on the market. See my Micro "M" portable charge controller in the September issue of *QST* if you want a charge controller for your portable station.

"This power supply will produce 12 volts at 1.5 amps, and it costs only six bucks."

Low-priced power supplies

I'd guess most QRPers have access to several sources of power for their rigs. If not, and you don't want to home-brew one, I have found several that will power a QRP rig. The best part is the price. These power supplies are surplus and were made to power laptop computers.

Many of these supplies are of the switching type. I'm not sure if the switching noise would get inside a direct conversion rig or not. Perhaps, but you should have no trouble running a superhet rig with one.

Hosfelt Electronics (800-524-6464) has several units that look good. One in particular is a tiny guy who measures only 6 by 2 inches. It will produce 12 volts at 1.5 amps. Best of all, it's only six bucks. Its stock number is 56-448. For $10 you can get one that produces 18 volts at 1.4 amps (40-140), ideal for battery charging. By adding on an external three-leg regulator you would have the basics for an adjustable power supply.

If the switching noise is getting into your rig, then Hosfelt has a linear supply that produces 12 volts at 3.4 amps (40-176) for $25.

DX news for QRP ARCI

Dick GØBPS has resigned as the UK rep for the QRP ARCI. What does this mean to you? If you live outside the USA or Canada you must now send your renewal fees directly to me and not to Dick. It also means we have to rethink the way you send your funds.

First, the QRP ARCI does not accept credit cards. Second, I know the price of getting an international money order often exceeds the price of the dues. So what's a ham to do? Send cash. Yup! I know, I've said it, they've said it, even your mother said it: Do not send cash in the mail. However, you can send cash if you follow these simple steps.

First, do not put my callsign or your callsign on the letter. You want the letter to look as generic as possible. Second, do not address the letter to QRP ARCI. Address the letter to me. Do *not* send the letter certified or requesting a signed return receipt. Remember, you want the letter to look just like one you would send to dear old Mom. Are you going to send *her* one by certified mail? I think not! If you want an acknowledgment of your letter and money, enclose a mailing label and first class unit of postage inside your letter. IRCs are fine if you have some lying about.

Wrap your money in either carbon paper or aluminum foil. This prevents prying eyes from seeing the money through the envelope. If possible, use large bills instead of singles or fives. A twenty and a five will mail cheaper than five fives. Some of the postage rates are incredible, one reason why the QRP ARCI has raised the DX dues to $25 a year for airmail delivery.

For all members of the QRP ARCI, I've moved. The new address is:

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Now that we have built several converters and covered them in quite a bit of detail, I am ready to put the cart before the horse, so to speak, and discuss IF system operation. I admit that I did not plan to cover this aspect of microwave operation because it just didn't *occur* to me before.

I have been an amateur for a good number of years and have accumulated quite a pile of material that I draw upon to construct projects. I've been known to take an existing complete radio which has fallen into disuse and construct something inside it, changing the main function completely.

Back then, when radios were not quite as small as today's devices, there was plenty of room to construct adjuncts into a radio case, changing the rig's operational point of view while retaining the beauty of the original product. Take, for example, one of my early converters, constructed to replace my 2 meter transmitter and separate receiving converter. At that time I was using a tube-type transmitter for 2 meters that was crystal-controlled on 145.5 MHz (AM) and ran with three 6AQ5 multiplier tubes and a single 6C4 oscillator. You might point out that the 6AQ5 was an audio amplifier. I agree, but it worked. The receive converter was a premium crystal-controlled downconverter from 144 MHz to 14 MHz for the IF frequency.

This project gave me a deluxe 2 meter station (and the beginnings of 2 meter SSB operation), using mostly scrounged junk. This was my start with VHF and the late '60s/early '70s construction. My tool collection included a round rasp file and rattail file to round out holes drilled on the back porch to hold tube sockets, meters and such. Quite a humble start.

I think back to those days and the enjoyment and struggle that I went through to put together what I consider quite easy today. How much time I could have saved if I'd had a better grasp of technical details and math applications! Today, with a computer at my home and model simulation at my fingertips for circuits that were bench-top struggles then, I can make vast improvements, even using a slow 286 IBM mainframe.

"Sometimes you eat the bear—and sometimes the bear eats you."

The main shack VHF receiver was a National NC-303, about the size of an apple box. The plan was to take a recent surplus Heathkit 20 meter single-band transceiver and convert it to 2 meters. I was able to pick it up for minimal cash output as parts were missing and it was unfinished. Well, to make a long story short, I removed the high power parts and finished the transceiver (20 meter), then mounted the 144 MHz converter and a transmitter from a salvaged Gonset transmitter for 2 meters. This new transmitter, though still crystal-controlled, used a 2E26 final and put out 5 watts (AM).

All this was stuffed into the Heathkit 20 meter monobander.

Yes, I still have a 286, and even some old CPM machines that still function. They sit next to my 486 super-duper speedster. I guess it's always speed and performance for the assistance of man, but I still retain the slower, more comfortable old shirt and blown-out tennies for when the mood strikes.

Well, there you have some of my deep dark projects of years gone by. The ideas still have a familiar ring; only the tune has changed a bit. Today we build converters into cases that seem to suit the material and retain the IF system outside the environment of the converter. This is because the IF system is in plentiful supply due to the very heavy use of 2 meters and multimode rigs.

Sure, some of these rigs are old by today's standards of CTCSS tones and two or more synthesized VFO oscillators or programmed frequency entry. Don't be fooled by the expensive price tags on the newest rigs and let that prevent you from using a simpler version of the same radio. Look in the used market for a suitable unit that might not have all the newest bells and whistles. Used equipment stores and flea markets may provide an IF system that can be applied to microwave converter use.

A bargain can be had, especially if you purchase a blown or defective radio that might have a high power transistor amplifier stage destroyed. Don't tell the person you are haggling with that this is just what you desire, as you don't need a power amplifier in your IF system radio. (*My Rule #1: I disable all power amp stages as it is not a requirement in converter use.*) A low power output in the 100 milliwatt range is ideal as you still need to reduce it to +10 dBm from this power level.

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At the 100 milliwatt power range (100 mW) we still need a small value of attenuation to reduce power for input to a microwave mixer. While there are mixers that will handle 100 mW +20 dBm of power, most prefer +10 dBm. Converting power in watts to dBm might seem a little intimidating at first but it is quite easy if you know a couple rules of power. The main rule is that every power change in watts that doubles or divides by two results in a 3 dB change in power. A 10 watt radio output power is the same as stating your radio outputs power of +40 dBm; 10 watts and +40 dBm are the same power level, just stated differently. Now subtract 3 dB from the +40 dBm level: -3 dB = +37 dBm = 5 watts of power. Keep going and the following is true: +34 dB = 2.5 watts, +31 dB = 1.25 watts, +30 = 1 watt, +27 = .5 watt and +20 = .1 watt or 100 milliwatts.

Why use a 30 dB attenuator to reduce a 10 watt transceiver power to +10 dBm for input to a mixer? Yes, it can be done, but you're wasting a lot of battery power in portable operation and giving it up as heat with no useful application. The same transmitter with the power stage removed or disabled can be put to much better use with less drain on portable batteries.

Rule #2: My used 2 meter transceiver doesn't have any repeater tone control built into the radio. Well, this is a benefit again because the CTCSS tone and repeater subaudible tones are not used on the microwave bands. Details like this make the radio somewhat high on the priority list to be replaced from a repeater operator's point of view. Many amateurs will take this older equipment's used value in trade towards the purchase of newer transceivers. This is where the microwave land sharks come into play, trying to locate these older transceivers, especially the units capable of SSB operation.

Where can you find these transceivers capable of SSB operation? Well, try your local flea market and ham club swap meets. Do what the big guys do—advertise. Use a small file card on your club bulletin board or at your local ham radio store's courtesy bulletin board. Mention your wants during various net activities on the air. You will never know how successful you can be until you try some of these methods.

My successful finds

Some of the rigs that meet the multimode 2 meter plan of attack include the Santec LS-202, ICOM IC-202, IC-245, IC-260 and Yaesu FT-480. All of these radios are 2 meter capable and have SSB operation, and some have FM and CW. The LS-202 is a handie-talkie and a multimode miniature transceiver with SSB, upper and lower SSB, CW, and FM, in a pack with 8AA batteries. Its detriment is that the knobs are quite small, but it performs well in any mode of operation.

I obtained this radio as a basket case junker with no power transistor, driver, and a busted audio potentiometer, and it arrived in 10 pieces. It wasn't *that* bad as most of the wiring was still in place because it had been disassembled for repairs that were never made. It sat in someone's junk box for quite a few years until I asked the question, "Got any multimode rigs?" It was brought out and I bought it. The seller would have never thought about selling it, and was almost not going to sell it because it was in such bad shape. But I insisted that I was willing to take it without any guarantees. That satisfied the seller, relieving him of any obligation. That was some six years ago and since then that radio has operated well, with only three other trouble/repair scenarios. These were completed and it's still working today as my smallest portable multimode radio.

You might think me crazy because of some of my other choices. I obtained an IC-245, with an SSB/CW adapter, that had driven its owner nuts with drifting VFOs and intermittent operation. In a chance encounter he offered it to me for $5, so he could be rid of the dreadful device.

Well, my first ICOM radio was an IC-211 that had similar problems, and this IC-245 was a mobile version of that same radio. The circuitry problems that I troubleshot over several years on the IC-211 related to the plated rivets used to connect the top and bottom PC board traces. They became flaky in the conductivity department with time, even with soldering, and would go open. (The fix put a wire through the rivet and bond to top and bottom trace of the PC board.) Having spent a bunch of time to repair the IC-211 (a repair job approaching an act of love), you could say I got a real education on very early ICOM radios. I applied the same fix to the IC-245 that I had used for the IC-211.

"Don't attempt to repair an expensive piece of equipment before doing your homework."

Standing now on familiar ground (the IC-211 and the IC-245 synthesizer are exactly the same), I grabbed the file with my repair notes on where all the solder rivets were on the synthesizer chassis, and other shortcut fixes I used in repairing the IC-211, and installed the standard fix to the IC-245. I put the covers back on and applied power, and I lucked out! It worked right off the bat. It has one related idiosyncrasy that I am still trying to fix but that is intermittent—it only happens about twice a year.

Would everyone tackle such a project? Well, we will never know the answer to that one, but if you should choose to attempt such a task it can only reap rewards. This reward might only be increased technical awareness—but be patient and don't spend a lot of money to only tempt fate. Be prudent and improve your troubleshooting and repair skills using inexpensive items to work on at first. Don't attempt to repair an expensive piece of equipment before doing your homework. Build up to the experience level needed to work on a complex piece of equipment. You'll improve with time.

What was the disposition with the Yaesu FT-480 multimode rig? It was purchased at a swap meet from an unfamiliar person and was advertised to be in good shape and tested. Well, the price dropped when there was no mike or power cord to be had, nor any manual. This to me meant the radio was in very dubious condition and unchecked. With my hand still on the unit, and alert for other bargain-hunters, haggling commenced. Soon a mutual price was worked out and it was mine.

I took it home and made a power cord and mike, turned it on, and the receiver was dead. No audio at all, with or without the squelch ... nothing. The frequency dial responded OK so I tried transmit in low power and it worked well and on frequency. Looking at the chassis, which had a very tightly-packed component high-density construction, I opted to order the manual and schematic before beginning surgery. The manual was very reasonable—$20—and available from Yaesu (my hat's off to Yaesu and their excellent service department).

I received the service manual and in the troubleshooting guide there was my exact trouble condition as trouble #1. The fix? Replace a dirty miniature relay contact used to switch a DC voltage between the transmit and receive control circuits. Three minutes to fix the radio and 10 minutes to put the covers back on. It had been a simple problem, but a hard one to locate without the manual. Sometimes you eat the bear—and sometimes the bear eats you.

In retrospect, I guess I got eaten by the bear in my dealings with my IC-211 repair job and pulled off a reverse on the LS-202 and the IC-245. It takes persistence and application and the willingness to overcome repair obstacles to extract a bargain from surplus or swap meet sources. Have I ever received perfect equipment from swap meet sources? Absolutely! An IC-260 multimode 2 meter rig in perfect shape. Don't cast doubt on everything, just examine it

carefully instead of letting emotion run the purchase.

The 2 meter IF system

What is the best attribute of the radios I have described so far, and what improvements would I suggest? Well, by using a 2 meter IF system for your microwave converter you have the ability to utilize its different modes of operation: SSB, CW, and narrowband FM. Additionally, you have an accurate frequency dial to amble about your converted microwave frequency, usually the selected converter frequency plus 4 MHz of tuning range.

If you were operating at 5760 MHz and using a 144 MHz IF then you can span the 5760 MHz to 5764 MHz tuning range on the IF system at 2 meters via the converter. This gives you a great receiving and transmitting system by allowing the IF system to basically run the show. Allowing for transmitter power reduction or disabling the power stage is a must for converter use. Also, a point to consider is the frequency control knob on most of these transceivers I have described. With the exception of the IC-211, all have detent-type harsh tuning for frequency control of the 2 meter radio.

I wish some of the manufacturers would take heed and produce a radio capable of making the transition from a multimode transceiver with power and sensitivity to a low power converter mode device. There should be some means to shut off the power stages and bypass them for low power output, not switched low power. Having a switch that changes power level is not prudent to run switched low power into a microwave converter. While this option will work, it can destroy the converter's low power input mixer and other circuitry if the power switch is accidentally bumped or operated. It is better to have a fixed hard pulled-down low power conversion that will not harm a sensitive expensive microwave mixer.

Well, that's it for this month and this year. I hope you and yours have a very Merry Christmas and a Happy New Year. Best 73 Chuck WB6IGP.

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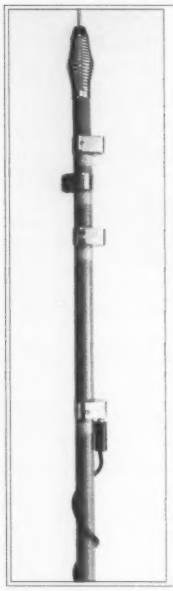
Perfect Stocking Stuffer

Alinco Electronics introduces the DJ-S41T, a handie-talkie transceiver that operates on the 70 cm (440 MHz) band. It's only slightly larger than most pagers, runs on three AA batteries, and it's priced under $150 at most Alinco dealers.

At a price nearly everyone can afford, the DJ-S41T features 21 non-volatile memories, CTCSS encoder, offset capability up to 15.995 MHz, and transmits with a power of 340 milliwatts, more than adequate to hit repeaters or carry on simplex communications over a considerable distance.

The DJ-S41T has a pivoting "swing up" antenna, keeping the radio compact enough to carry in purse or pocket, on a belt like a beeper, or in a kid's backpack; and if you don't have to detach the antenna, you probably won't misplace it. The universal reaction when people try out the DJ-S41T is "How can I get one?" Find out for yourself at your nearest Alinco dealer.



Slimline Mobile Antenna

Palomar Engineers announces a new slimline mobile antenna for the 75, 40, 20, 15, 10, 6 and 2 meter bands. The AN-7's Fiberglas™ base section is four feet long with a spring protected three-foot whip on top. Change bands by selecting taps on the helical base coil. The AN-7 was developed by Antronic, a major South African manufacturer, and has been in use in the South African bush country for years—it is now available in the United States for the first time.

The complete antenna weighs only two pounds and presents a very small wind-loading area. Its discreet size and attractive finish make it suitable for use where other antennas would not be permitted, and it's priced at only $249.95.

For more information, contact Palomar Engineers, P.O. Box 462222, Escondido CA 92029. Telephone 619-747-3343, FAX 619-747-3346, or E-mail 75353.2175@compuserve.com.

Affordable DSP — to Go!

Kenwood's new TS-570D HF transceiver offers the world's first CW Auto Tune feature, which eliminates VFO adjustments during CW operation. The TS-570D also has a Radio Control Program that will be available for operators to design and program multiple radios with custom settings while conventionally saving them to a file for future use.

If you've been waiting for a DSP (Digital Signal Processing) HF radio that'll fit into your budget, check with your authorized Kenwood dealer for details, so you can enjoy the TS-570D, destined to take its place alongside other world-renowned Kenwood rigs like the TS-50S.

Atomic Clock Accuracy

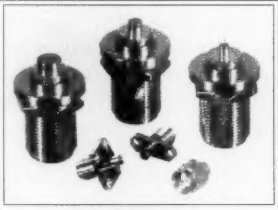
Novatech Instruments, Inc. introduces the Model 2955AR Rubidium Standard with Synthesized Output. It has a direct digital synthesizer output that is 32 bit programmable from 10 Hz to 4 MHz, and fixed outputs of 10 MHz and 1 MHz. The 2955AR contains an Atomic Resonance Rubidium Oscillator and has long-term stability of better than 5×10^{-11} per month and short-term stability of better than 0.7×10^{-11} in 10 seconds.

There's an EEPROM memory in case of power shutdown, and it's ideal for use in communications system applications since the 2955AR can be set to standard frequencies such as the 1.544 MHz T1 frequency. Of course, it's also perfect for laboratory and ground station use, as a master oscillator, as well as for tests and calibration, and the 2955AR is attractively priced at $4,295. You need one. Yes, you do. Check out the specs on the web site at http://www.eskimo.com/~ntsales, or write Novatech Instruments at 1530 Eastlake Avenue East, Suite 303, Seattle WA 98102.

Sunspot Cycle Got You Down?

Down on the lower HF bands, that is? Bilal Company may have the answer for acreage-challenged hams who want to work the 160 meter band. Many conventional HF antennas require lots of space—but the new Isotron 160C is under 10 feet tall and mounts on a conventional mast. This resonant antenna requires no radials, is tunable and can be set for a preferred portion of the band.

You'll be impressed by the Isotron 160C's transmitting and low-noise receiving performance; and it's only $159.95. For more information about the Isotron antenna line or a free catalog, contact: Bilal Company, 137 Manchester Drive, Florissant CO 80816.



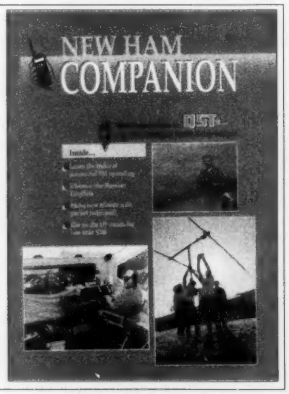
Connectors

RF Connectors has released two series of connectors for semi-rigid cables. Rear-mount N female bulkhead connectors are available to accommodate .086, .141, and .250 cables. SMA plugs, bulkhead jacks and two-hole and four-hole panel mount jacks are available for .086 and .141 cables. Connectors feature Teflon™ insulation, gold contacts, and nickel or gold plating.

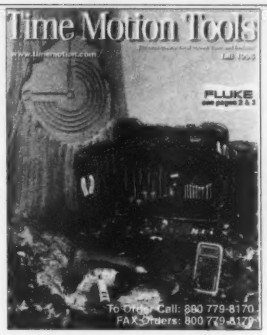
The connectors are available from RF Connectors distributors throughout North America. For additional information, specs, and availability, call 800-233-1728 or E-mail: 102061.2261@compuserve.com.

It's Worth It

New Ham Companion from the ARRL. With the League membership growth stagnant, and the only significant growth in the hobby being the no-code licensees, the League has addressed this group with a 64-page booklet (about half of it is ads). It explains how repeaters work, about packet, antennas, satellite contacts, learning the code and low-cost low band QRP. You get your $2 worth.



Spiffy Free Catalog



Time Motion Tools has released its new 172-page catalog of tools—and it's full of cool toys: hand tools, power tools, lighting and magnification tools, all kinds of meters, including the new Fluke 7-300 and other Fluke meters. If you haven't yet got hold of this one, write or call Time Motion Tools, 12778 Brookprinter Place, Poway CA 92064. Phone (800) 779-8170, FAX (800) 779-8171; or visit their web site at http://timemotion.com.

Get More Ladders!

Cable X-Perts, Inc. announces two more ladder line cables—the 300 Ω ladder line cable and the 14ga 450 Ω ladder line cable. These balanced transmission cables provide low loss attenuation across the HF (>30 MHz) bands. Prices start at 100 feet and up—0.13/ft for the 300 Ω version and 0.25/ft for the 14ga 450 Ω version—discounts apply at 500 ft and 1000 ft quantities. For more information and other special offers SASE to: Cable X-Perts, Inc., 416 Diens Dr., Wheeling IL 60090. Phone orders only (800) 828-3340, or E-mail: cxp@netcom.com.

CAT Got Your Code?

Computer Aided Technologies announces the Code 3-Gold, a new VHF and shortwave decoder that uses the best of software detection technology and the latest in miniaturized electronics for the hardware interface.

Systems supplied as standard include packet, BAUDOT, SSTV, NAVTEX, PACTOR, and more. For further information, contact Computer Aided Technologies at P.O. Box 18285, Shreveport LA 71138, or call (318) 687-2555. Internet users can contact the company on the WWW at <http://www.scancat.com>.

It's Like Being There

Pacific-Sierra Research Corporation offers a guided Internet tour of their new HFx software, which provides quick, easy accurate propagation predictions. HFx calculates ionospheric signal strength from 2 to 30 MHz, using an intuitive Graphical User Interface. The central feature is the HFx Interactive Map, which can display the subsolar position, day/night terminator, the great-circle path between transmitter and receiver, major cities, and the high-latitude auroral ovals. Just click the mouse!

It's designed especially to be easy enough for beginners to use, and thorough enough for experts, and it's only $129 postpaid worldwide—check it out at the HFx home page: http://www.psrv.com/hfx. For more information or to order, contact HFx - Dept. 73, Pacific-Sierra Research Corporation, 2901 28th St., Suite 300, Santa Monica CA 90405-2938, USA. Phone (800) 820-4PSR; outside US and Canada (310) 314-2346; FAX (310) 314-2323.

Orchid City's Newest

Orchid City Software has completed the Voyageur v1.1 Radio Database for DOS, a comprehensive suite of database programs for broadcasting radio stations' information gear toward the radio DXer and listener. You want to know what's going on in the DX/SWL world? Here's a list of DX/SWL program schedules. Find any program by the day of the week, time of day, station, etc. You've got a program for writing log reports and printing in a number of formats—type it once and print multi formats. Schedules, frequencies, addresses, radio station slogans—in English, Spanish, Indonesian, French, Portuguese, and more!

The Voyageur v1.1 already contains thousands of records and is completely read/write; it can be updated, changed, or added to easily. To order your copy send $29.95 to Orchid City Software, P.O. Box 18402, West Palm Beach FL 33416. Overseas orders add $10.00 for additional postage.

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 88 for ordering information.

Great ARRL Books!

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AR4173 **Now You're Talking! All You Need To Get Your First Ham Radio License**–A complete study guide for the Technician and Novice written exam. Practical information every beginner needs is written clearly and simply and in small doses. $19.00

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AR2973 **Complete DX'er** by Bob Locker W9K1 Learn how to hunt DX and obtain hart-to-get QSL cards. $12.00

AR0402 **Solid State Design** Good basic information, circuit designs and applications; descriptions of receivers, transmitters, power supplies, and test equipment $15.00

AR4661 **ARRL's Antennas & Techniques for Low-Band DXing** can be your ticket to low-band success. $20.00

AR1996 **The ARRL 1996 Handbook** includes the latest innovations in ham radio. plus all the fundamental data. $38.00

Books for Beginners

TAB4354 **Beginner's Handbook of Amateur Radio** by Clay Laster W5ZPV. 395 pages. Wonderful book for newcomers. It is basic and well illustrated. Even if you have all the other ham handbooks, you'll still find this one useful. $22.00

W5GWNV **No-Code Video, Manual, Part 97 Rules** by Gordon West Learn how to be a ham radio operator $29.95

W5GWNC **Technician Class License Manual: New No-Code**–by Gordon West This book covers everything you need to become a Technician Class Ham. Every question and answer on the examination is found in this one book. FCC Form 610 application. $9.95

Antenna Books

UE220 **The Easy Wire Antenna Handbook** by Dave Ingram K4TWJ. All of the needed dimensions for a full range of easy to build and erect "sky wires." $9.95

WGP87034 **All About Cubical Quad Antennas** by William Orr and Stuart Cowan "The Classic" on Quad design, theory, construction, operation. New feed and matching systems. New data. $13.95

TAB3270P **Practical Antenna Handbook**–2nd edition by Jos. Carr. This 560-page book is a treasure. Starts with fundamentals, explains propagation of all kinds, and provides a ton of easy antenna projects. $26.95

WGP87077 **Simple, Low-Cost Wire Antennas For Radio Amateurs** by Willliam Orr and Stuart Cowan. Low-cost, multi-band antennas; inexpensive beams, "invisible" antennas for hams in "tough" locations. $13.95

Mobile or Chairside HT Holder

A simple, practical project based on a boat accessory.

Peter L. Barker XF1/KB6ASH
La Jolla de Los Cabos AB-506
San Jose del Cabo
B.C.S. 23400 Mexico

My other hobby besides amateur radio is sailing. As with ham radio, many "cute" products are developed for that market. One of the best-known is an ashtray mounted on a small beanbag so that it can be safely used on a boat in motion. I was looking at this one day and it occurred to me that this simple idea could be applied to a holder for an HT on board, in the car, or even by the favorite chair at home. Like many simple ideas, creeping elegance set in and the project soon started to mushroom into a universal holder. Eventually common sense prevailed and I came up with the idea described here. Even if you don't have a wife who is a talented seamstress, as I do, this project should be within the capability of any determined "putterer."

Make a simple bracket in the shape of an acute-angled "L" from aluminum, Plexiglas™ or thin plywood. Choose the size and angle to suit the radio and the desired operating position. The length of the foot of the "L" should be at least half the length of the long side.

The "beanbag" can be made of almost any material or fabric that is not slippery. The "beans" (or in my case, sand) are poured into a locking plastic bag and slipped into the beanbag. The bottom of the "L" is inserted into a pocket sewn onto the outside of the top layer of the bag. The bag is then folded over to sit with the weight of its contents resting on the foot of the "L." If the material used to form the "L" proves to be too slippery to allow the belt clip to hold the HT securely, a piece of thin rubber, such as inner tubing, or fabric can be glued on with contact cement to provide added friction. Alternatively, an elastic band can be slipped over the "L" and the radio.

I have used this simple support successfully on a heeling sailboat, in a bouncing Bronco (Ford type!), and next to my TV chair.

Oh, the creeping elegance... pocket for speaker mike and spare battery pack, a dual-radio model, Velcro™ closures, cable strain relief, etc.

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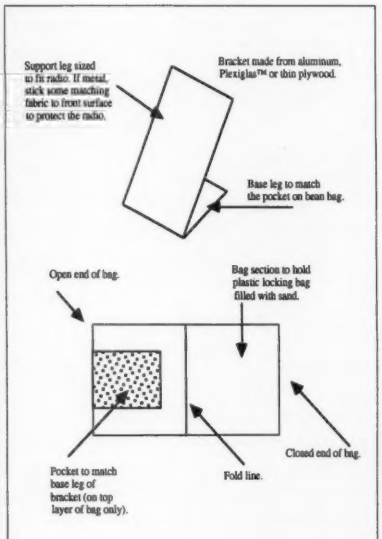
Support leg sized to fit radio. If metal, stick some matching fabric to front surface to protect the radio.
Bracket made from aluminum, Plexiglas™ or thin plywood.
Base leg to match the pocket on bean bag.
Open end of bag.
Bag section to hold plastic locking bag filled with sand.
Closed end of bag.
Fold line.
Pocket to match base leg of bracket (on top layer of bag only).

Fig. 1. Beanbag mobile HT holder. A) Bracket. B) "Beanbag," made of denim or light canvas.

PROPAGATION

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

Radio propagation on the HF bands this month suffers from seasonal lows combined with low solar flux values near the bottom of sunspot cycle 22, although there is hope for substantial improvement during 1997. In general, QRN will be low and the bands quiet.

The best days are expected to be the 2nd–5th, 9th–12th, and 14th–17th. The worst days are expected to be 6th–8th, 18th–23rd, and 27th–29th. Use the accompanying calendar to guide your operations. There may be some intensive geophysical effects felt on or around the 20th and 21st, possibly ionosphere/atmosphere-related, earth-related, or both. Stay alert and prepared.

DECEMBER 1996

SUN	MON	TUE	WED	THU	FRI	SAT
1 F	2 F-G	3 G	4 G	5 G-F	6 F-P	7 P
8 P-F	9 F-G	10 G	11 G	12 G-F	13 F	14 F-G
15 G	16 G	17 G-F	18 F-P	19 P	20 P-VP	21 VP-P
22 P	23 P-F	24 F	25 F-G	26 G-F	27 F-P	28 P
29 P-F	30 F	31 F-G				

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA	20	40	40	40	80	80				20	15	15
AUSTRALIA	20		20		40	40	20	20			15	15
CANAL ZONE	15	20	20	40	40		20	20	15	15	15	15
ENGLAND	20	40	80	40	40		20	20	20	20	20	20
HAWAII	20		20		40	40	80	20			15	15
INDIA	20					20	40	20				15
JAPAN	20						20	20				20
MEXICO	15	20	20	40	40		20	20	15	15	15	15
PHILIPPINES							20					
PUERTO RICO	15	20	20	40	40		20	20	15	15	15	15
SOUTH AFRICA			40	40				15	15	15	20	20
U.S.S.R.	40	80	80	40			20	20	20			40
WEST COAST		80	80	40	40	40	20	20	20			

CENTRAL UNITED STATES TO:

ALASKA						80	40	20				
ARGENTINA	20		40	40	40						15	15
AUSTRALIA	15					40	20	20	20			15
CANAL ZONE	20	80	40	40	40	40	20	20	15	15	15	20
ENGLAND	40	40	40	80				20	15	20		40
HAWAII	15	20			40	40	40				15	15
INDIA	15	20	20				40	20	20			
JAPAN						80	40	20				
MEXICO	20	80	40	40	40	40	20	20	15	15	15	20
PHILIPPINES								20				
PUERTO RICO	20	80	40	40	40	40	20	20	15	15	15	20
SOUTH AFRICA	20	40							15	15	20	20
U.S.S.R	40		40	40				20	20			

WESTERN UNITED STATES TO:

ALASKA	15	20			40	40	40	40	40			20
ARGENTINA	15	20		40	40	40	40	40		15	15	15
AUSTRALIA	15	20	20				40	80	40	15	15	15
CANAL ZONE	20	20		40	40	40			20	15	15	15
ENGLAND			80	40					20	20		
HAWAII	15	15			20	20	20	20				15
INDIA		20										
JAPAN	15	20			40	40	40	40	40			20
MEXICO	20	20		40	40	40			20	15	15	15
PHILIPPINES	15	20					40	40		20		20
PUERTO RICO	20	20		40	40	40			20	15	15	15
SOUTH AFRICA	20	40	40							15	15	20
U.S.S.R.		40	40	40	40				20	20		
EAST COAST		80	80	40	40	40	20	20	20			

10–12 meters

A few possible daytime F2 layer openings to South and Central America on the Good (G) days.

15–17 meters

Fair DX openings on Good (G) days between noon and sunset, and short-skip openings during the daylight hours. The band dies at sunset.

20 meters

DX to most areas of the world during daylight hours, peaking a few hours after sunrise and again during the early afternoon. Although the band usually closes soon after sunset, you may find occasional openings to South America and Antarctica until midnight. Daylight short skip from several hundred to 2,000 miles or so possible on most Good (G) or Fair (F) days.

30 meters

DX toward the Europe in the late afternoon and evening on Good (G) days until midnight, and then toward the Orient in the early sunrise hours. Possible long-path DX in the morning and also short skip most days out to a thousand miles or more, and farther in the evening.

40 meters

DX toward Europe and Africa in late afternoon hours, toward South and Central America around sunset, and good openings to the West and South Pacific peaking around sunrise on Good (G) days. Expect daytime short skip to 1,000 miles, and 2,000 miles at night.

80–160 meters

Both are excellent bands for DX during hours of darkness, peaking at midnight and just before dawn. Daytime skip on 160 is nonexistent, but on 80 it can be up to 500 miles, and over 2,000 miles at night. On 160, short skip can reach from 1,000–2,500 miles at night. Experts prefer vertical polarization for transmitting antennas (low-angle signal take-off) and horizontal polarization for receiving antennas (less noise) on 160 meters.

Don't forget to listen—even on the worst days—as you may be pleasantly surprised; also, now and then CQ into a seemingly "dead" band for the same reason. W1XU. 73

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Very intuitive and visual . . . easy to understand! – *CQ (Japan)*

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How you can get the ham gift(s) you've always wanted ... and didn't know how to ask for:

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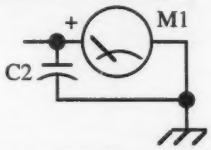
PERSONALLY, I THINK ALL THOSE PEOPLE AFRAID OF HEIGHTS ARE JUST PLAIN COWARDS!

UPDATES

Speaking Frank-ly about corrections...

"A Versatile QRP Random-Wire Antenna Tuner," Oct. '96, page 21: In the sixth paragraph in the first column, a line reads "... from wiper terminal 1 of S1..." It should read "... from wiper terminal of S1..."

Fig. 1 on page 19 seems to have been cut off (just like the tops of my family's heads when I take vacation photos). This is the ground that was missing:



And please check the Parts List; there are two corrections to be made to it. The first is that the "Toroid FT50 43 (L1)" listing should be deleted because it is redundant. Secondly (and lastly), please pencil in a 3 in the T1 listing so that it reads, "6 turns AWG-22 on FT37-43 core (see text)."

Once again, our apologies to Mr. Brumbaugh.

An economical high current mistake.

Fig. 4 of "Economical High Current Power Supply" on page 52 of June's issue contained a full wave bridge labeled D2. Half of it is backwards. Here's how D2 should look:

73

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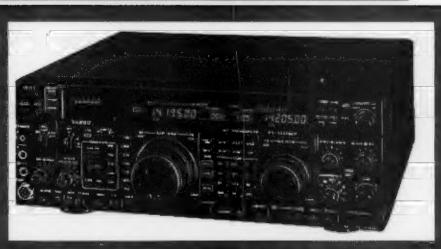

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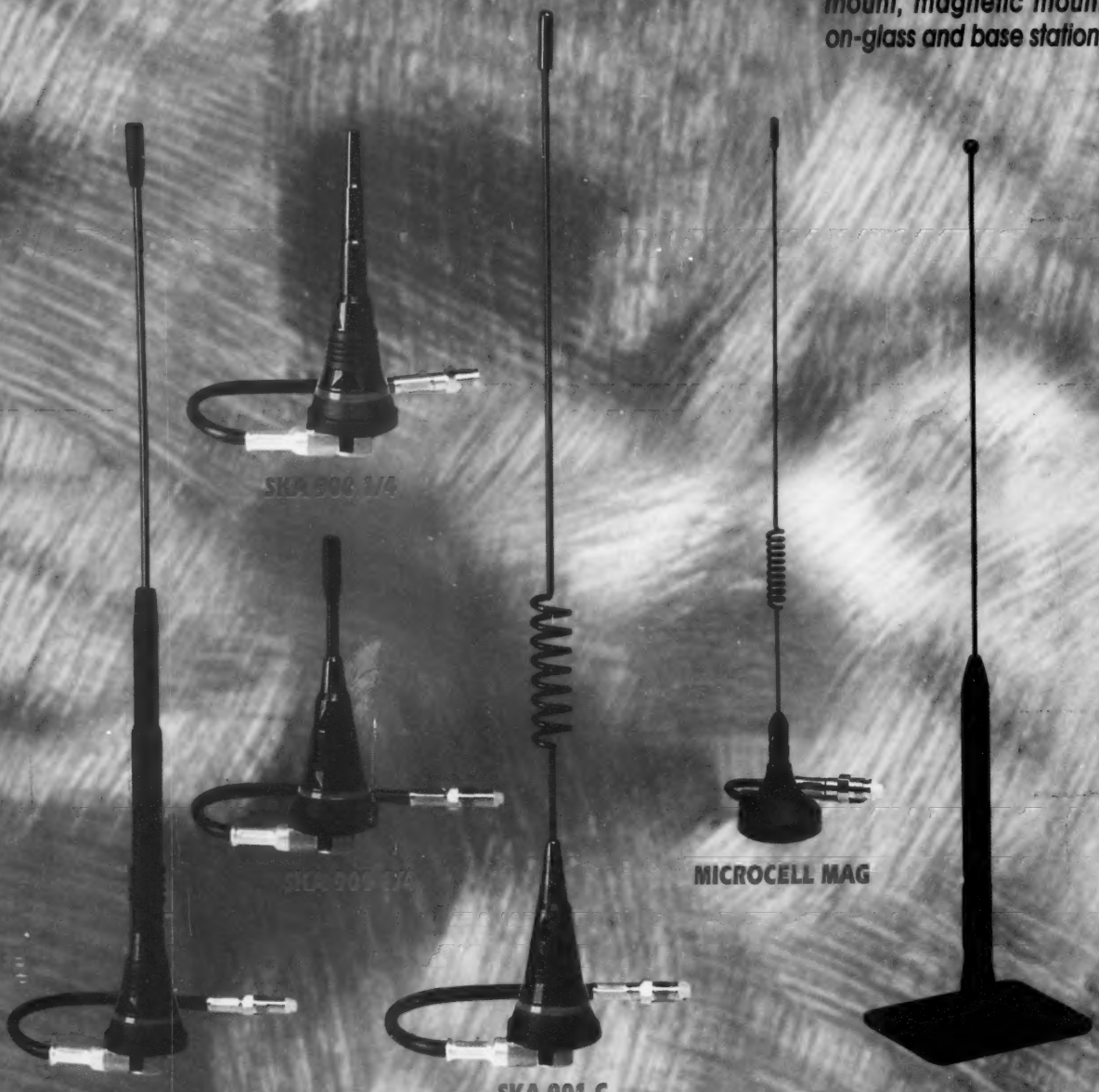

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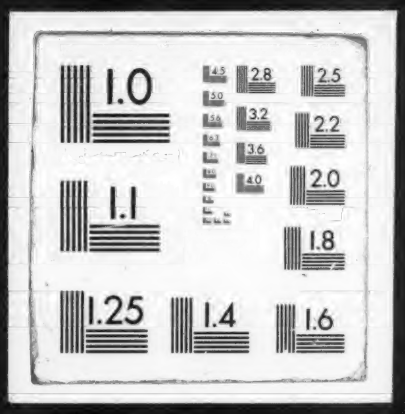
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